VOL. XIV No. IV APRIL 1929

MECCANO MAGAZINE

BRIDGING THE NIAGARA GORGE
(see page 274)

6d

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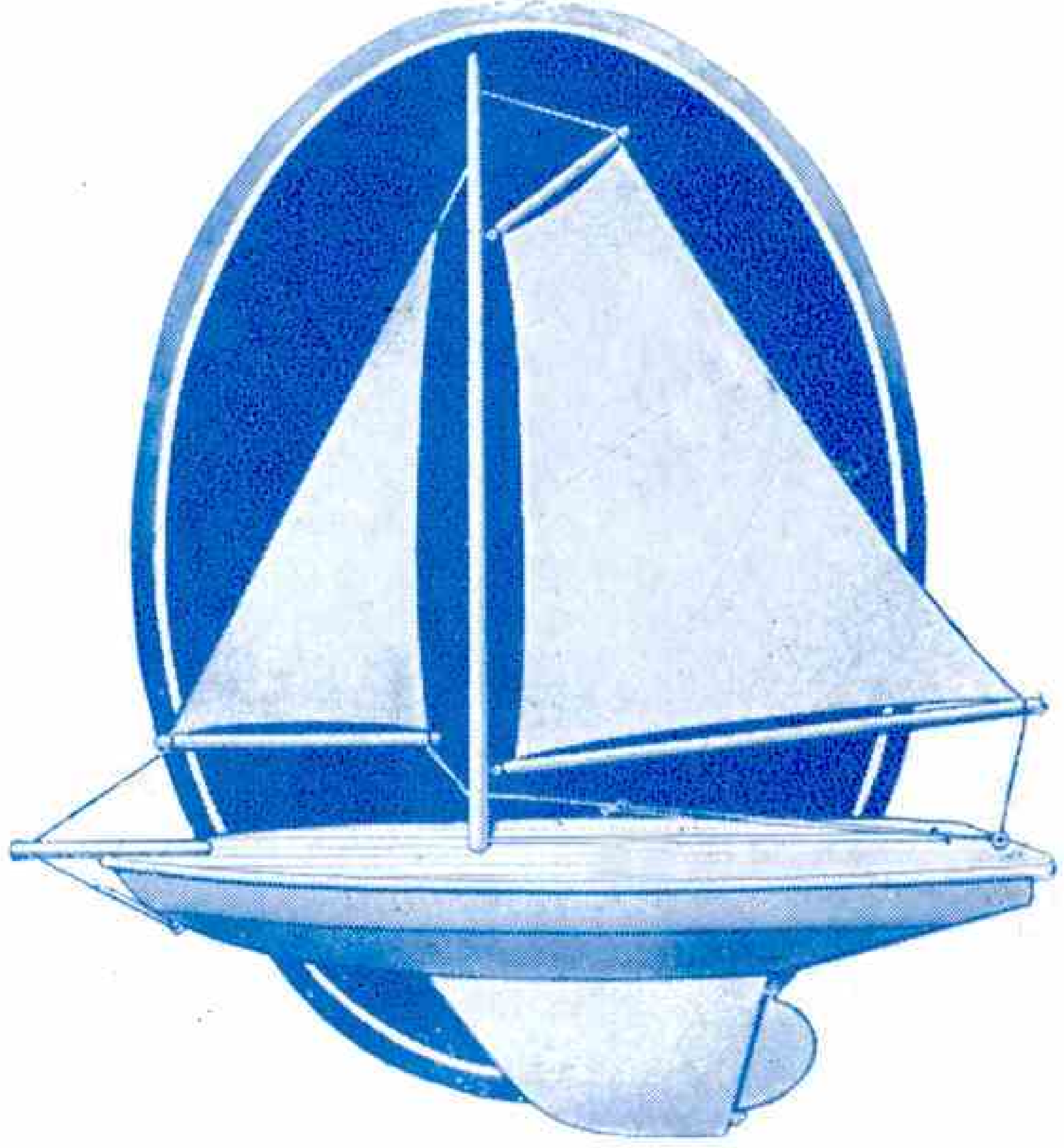

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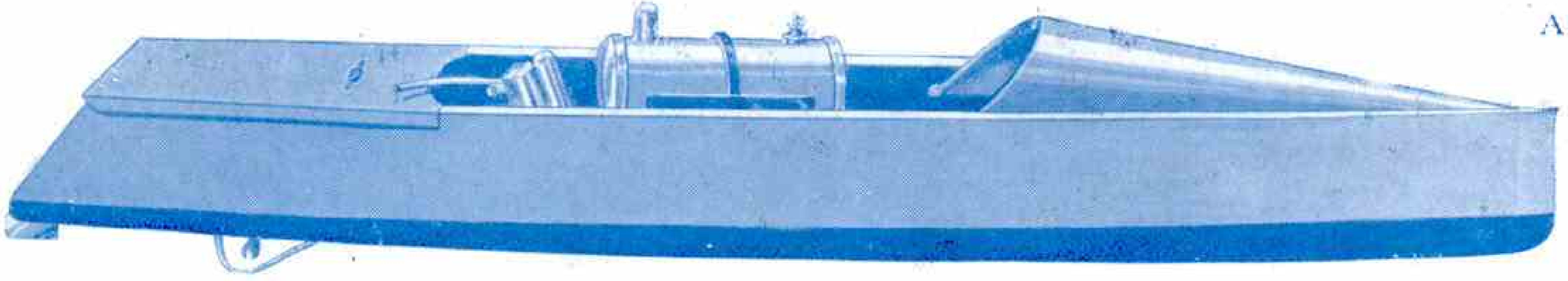

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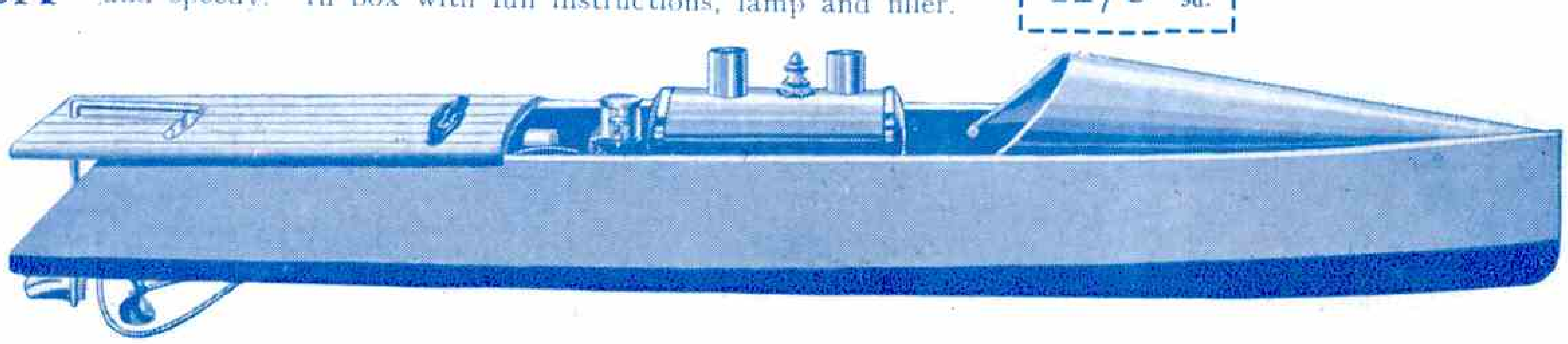

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NEXT MONTH: LIFE STORY OF A GREAT BELL. PUBLISHED: 1st MAY

MECCANO MAGAZINE

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April, 1929

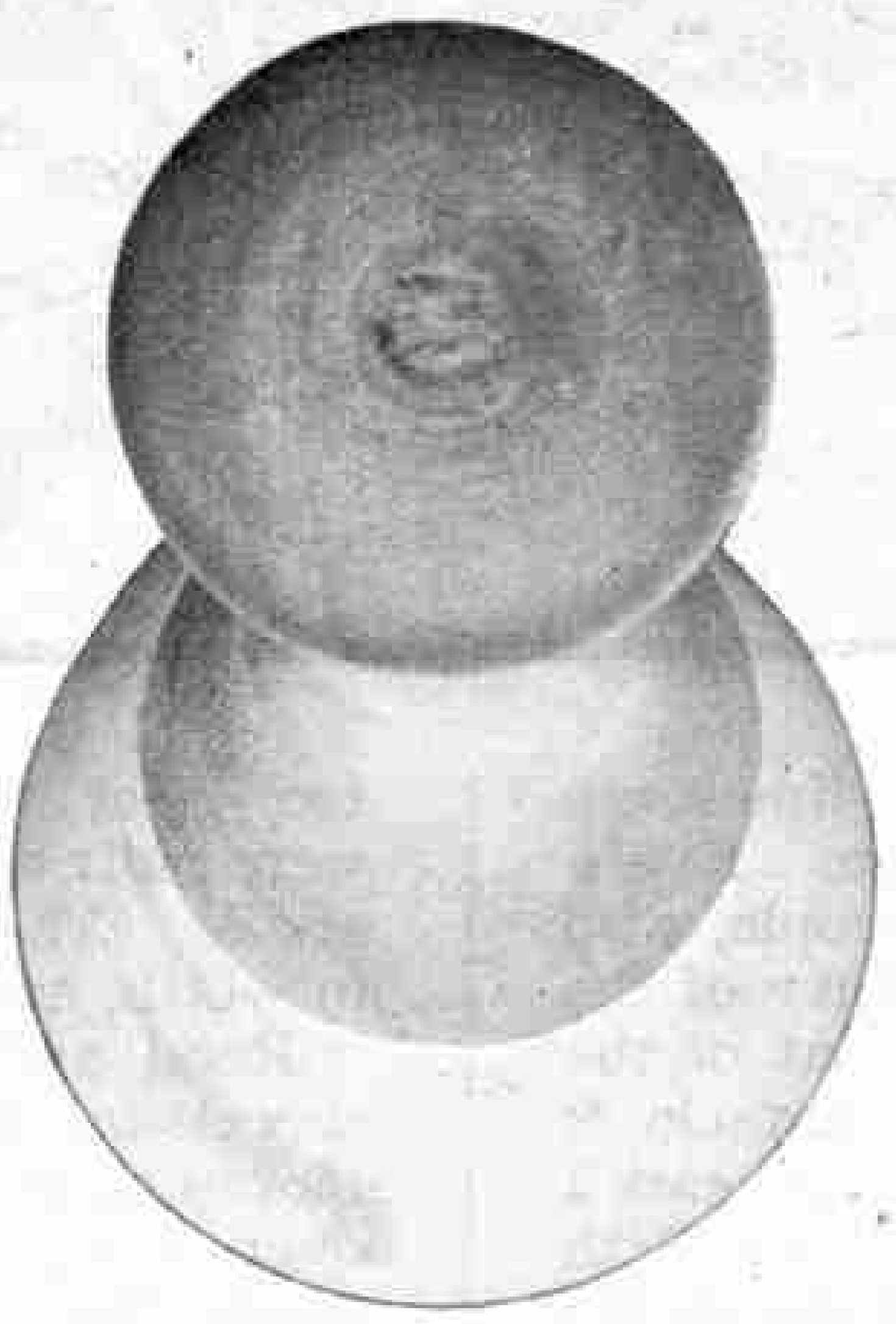
With the Editor

The Longest Word?

How would you reply if you were accused of "*superhyperprocontraantidisestablishmentarianisticismicatorialism*"? It would probably be some time before you would be in a position to decide whether you were being accused of a crime or a disease! This is one of the words with which I have been bombarded by readers since the publication (on page 265 of the March "*M.M.*") of a short note on the longest word in the English language. It is a remarkable effort, and contains 64 letters. Unfortunately it cannot be regarded as a genuine word, for it has been made by taking "disestablishmentarian" as a nucleus, and adding prefixes and suffixes to it in somewhat reckless profusion. Great ingenuity has been shown in building it up, but it is carrying word-building too far when the two prefixes "pro" and "contra" are used together on the ground that they cancel each other!

I have been interested to find that there is a word that seems to have a better claim to be regarded as the longest word in the English language than the example given last month. This is "antidisestablishmentarianistically," a word of 34 letters, submitted by a reader who tells me that it was used in Ireland 60 years ago. It seems to be quite a genuine word, although I have never seen it in print. Possibly there is a still longer word, and I will send an autographed copy of my book "*The Romance and Reality of Radio*" to the first reader who sends me a genuine English word that is longer than the one just quoted.

WHAT EVER IS IT?



No. 5. This is the fifth puzzle in the series of Mystery Photographs. Readers are required to identify this object, and to the first reader to send an exact answer, or to the reader who gets nearest, I will send an autographed copy of my book "Engineering for Boys."

Solutions should be written on postcards only and addressed "Editorial Competition No. 5, Meccano Limited, Old Swan, Liverpool." Closing date 30th April next.

The "March" Mystery Photograph

If the host of entries that poured into these offices with each succeeding mail delivery at the commencement of last month can be accepted as reliable evidence, our fourth "mystery" photograph was even less mysterious than its predecessors. Finding the winner was not a difficult task, for the first entry examined proved to be correct. Subsequent examination showed that more than 99 per cent. of the entrants had rightly identified the subject as a "spring paper clip." The first entry received was from W. E. Williamson, Liverpool, to whom a copy of my book "*Engineering for Boys*" has been sent.

The very high percentage of correct entries leaves little room for comment. With three or four exceptions, every incorrect entry could be grouped either as tweezers, tongs, forceps, or pincers. The exceptions were a mole trap, a patent clothes peg, a weed grubber, and, most marvellous of all, the "Le Chatelier" apparatus for measuring the expansion and contraction of cement in varying atmospheric conditions!

Unsuccessful competitors are reminded that it is our intention to give, at the end of the year, a consolation prize to every competitor who is successful in giving ten correct results without gaining a major award. This will provide compensation for the long sustained efforts.

Stick to Your Own Job!

I wonder how many of my readers have come across the story of the quarrel between the Captain and the Chief Engineer. The Engineer began it. He declared most emphatically that anyone could do a skipper's job, for all that was required was a little common sense and plenty of bluff! Naturally the Captain disagreed, and the argument grew fierce. Finally the Captain proposed that he should go below to show the Engineer how the engines should be run, and in the meantime the Engineer should take charge of the bridge. The Captain added that the Engineer would then realise that the duties of navigation were far beyond his intelligence! The Engineer agreed, although he did not put the matter in quite the same way. In fact, his reply was distinctly rude!

The two separated and went about their new duties. All went well for a time, but presently the Captain telephoned frantically to the bridge to inform the Engineer that the engines could not be got to work. The Engineer replied that it did not matter as the ship had run aground!

This story is not new, but I enjoy reading it every time it reappears. It is a good illustration of the great truth that each one of us is fitted by temperament or training, or both, for some particular job, and that we shall be wise to stick to that job. It emphasises also another point, and that is the foolishness of thinking that another man's job is easier than our own, and that we could do it as well as he can. It does not matter how simple a job may be, a certain amount of training is required in order to obtain the best results. As soon as we attempt to tackle a job of which we have no knowledge or experience, we find ourselves in the position of a square peg in a round hole, and we realise that a long period of work must elapse before our squareness disappears and we fit neatly into place. Such long periods of preparation may be monotonous or distasteful, but it is then that the foundations of great careers are laid.

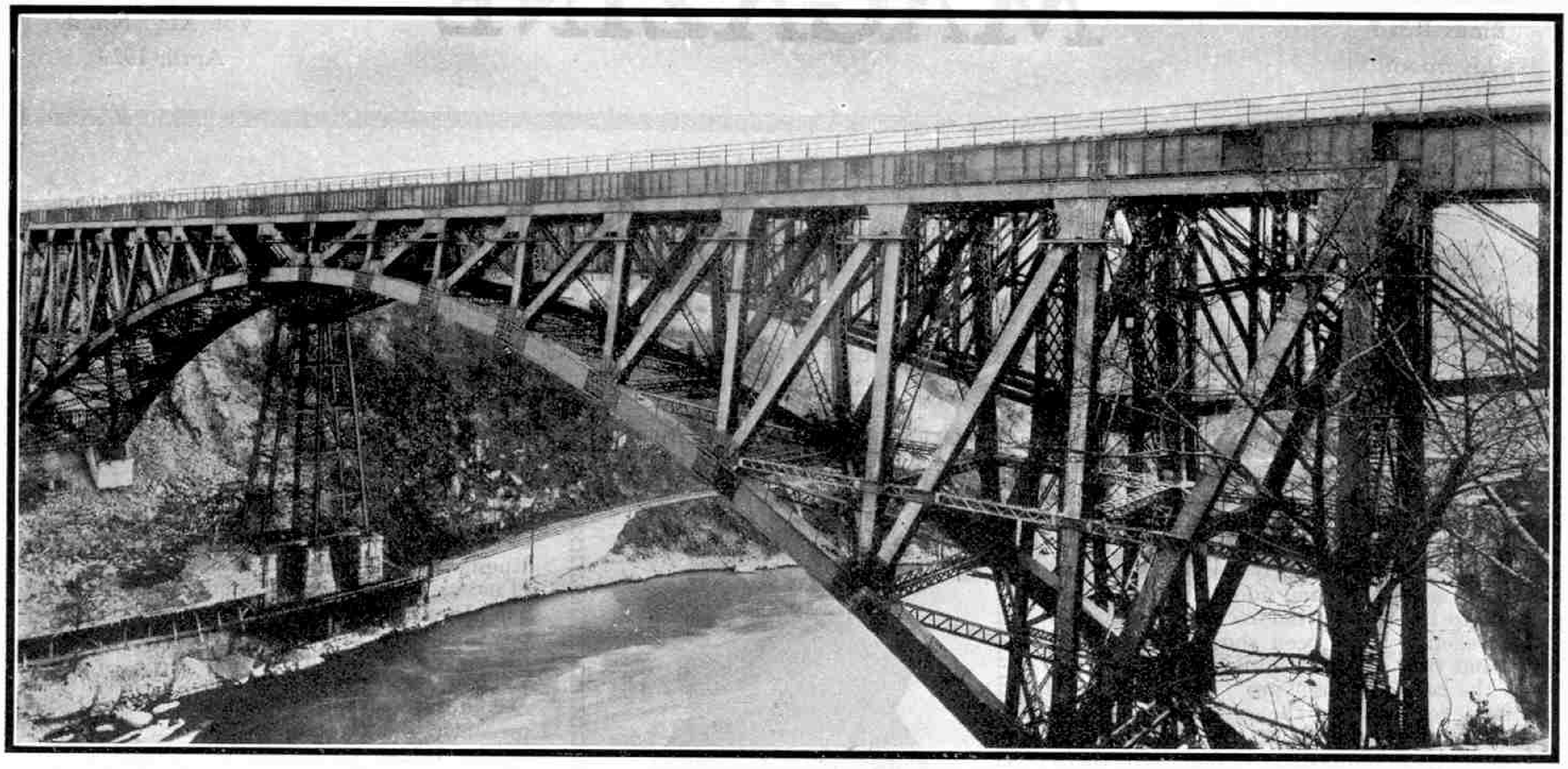
Major Segrave's Triumph

The world's record land speed has again been won for Great Britain. On 11th March Major Segrave succeeded in achieving the wonderful speed of 231.36 m.p.h. on his famous car, the "*Golden Arrow.*" This is a British-built car with a British engine, and Major Segrave's success represents still another triumph for British engineering. Two years ago he exceeded the existing record by 47 m.p.h. Last month he left no doubt as to the capabilities of his wonderful new car, for he raised the record by 24 m.p.h.

By the time these lines are in print Major Segrave may have captured another record, this time on the sea, with his motor boat "*Miss England.*" If successful, all that will remain to complete a wonderful series of British triumphs will be the winning for the second time of the Schneider Trophy and the establishment of a new speed record in the air.

Niagara's Most Imposing Bridge

How Its 640-ft. Steel Arch was Built



The above illustration shows the handsome steel arch bridge on which the tracks of the Michigan Central Railroad cross the gorge below Niagara Falls.

It is the most recent of the fourteen bridges that have been built over the Niagara River, and replaced the cantilever structure that may be seen beyond it. The older bridge was dismantled when the new one had been completed.

THE mighty avalanche of water that pours over the limestone brink of Niagara possesses a unique fascination. Every year the Falls are visited by more than a million people, who are awed by the stupendous rush of water and by the fury of the whirlpool in the great gorge that the river has carved out of the rock by centuries of ceaseless effort. This glorious spectacle is certainly a sufficient attraction in itself, but during recent years a new interest has been added to Niagara as a result of a vast growth of industry on both sides of the river. This new interest lies in the great engineering developments in the shape of vast hydro-electric schemes and of bridges across the gorge below the Falls.

The chasm below the Falls is an ideal place for the exercise of the art of bridge building. The banks reach a height of about 200 ft. above water level, and afford splendid conditions for the erection of really interesting structures. Engineers have taken full advantage of this, and a remarkable succession of bridges have been built at suitable points along a stretch of nine miles. Most of these bridges quickly became unequal to the task of carrying the ever-increasing traffic loads, and have been replaced by heavier and stronger structures. Of the 14 bridges that have spanned the turbulent river only four are now in existence.

The first bridge erected was a simple but very interesting structure, thrown across the river in the later forties of last century. "Flown-across" would be a better description, as the engineers responsible for it began their work by enlisting the aid of small boys who owned kites! These kites were used for bridging the chasm by means of light strings, which enabled the engineers to throw across heavier lines, and finally ropes and cables. On the last cable an iron basket was slung and in it passengers were drawn across the river at a charge of one dollar and a quarter per head! The basket in which this thrilling journey was made is now in the possession of the Buffalo Historical Society.

The number of people who desired to cross the river soon became too great for this primitive transporter bridge, and platforms were built on each side of the cable in order to allow them to walk across. These gangways—for they were little more—were 3 ft. in width, and for their use a reduced toll of 25 cents was charged.

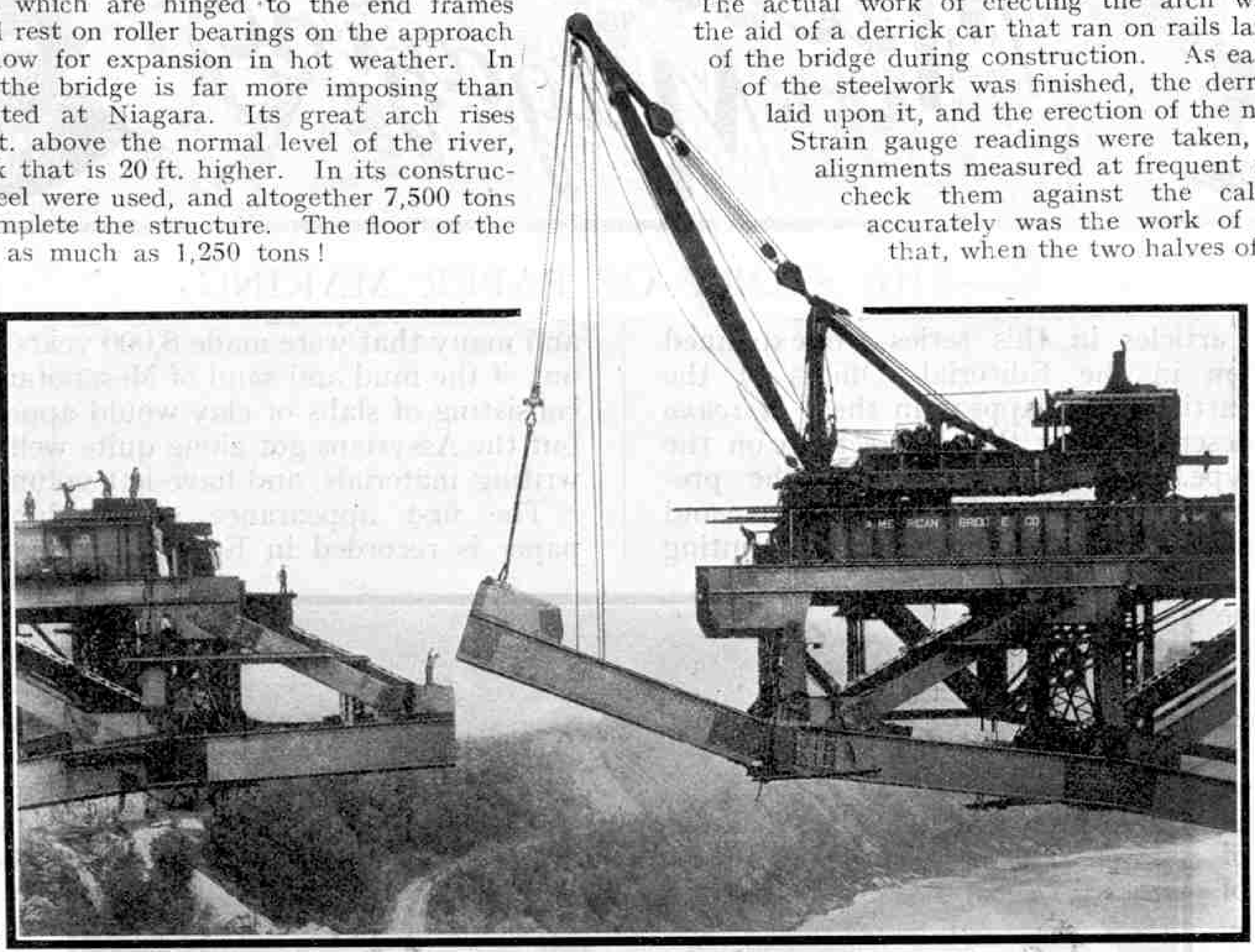
Road and railway bridges then followed each other in rapid succession as the need for improved means of crossing became more urgent. One of these was a light wooden suspension bridge, over which a famous locomotive of the time, called "*London*," made the first railway crossing on 8th March, 1855. Great indignation was aroused a few days later by the use of this bridge for Sunday traffic. One angry person went to the length of the following condemnation: "The awful violation of the Sabbath by long trains of freight cars with multitudes of men on top of them crossing and re-crossing the bridge and shifting the freight will not soon be forgotten by those who revere the holy day. The curse of God will rest on this bridge is my firm belief."

This denunciation must be regarded as a testimony to the value of the bridge, which carried such enormous quantities of traffic only a few days after its completion. The wooden truss was replaced 25 years later by steel, and eventually the structure shared the fate that appears to be common to the bridges that cross the gorge.

Of the four bridges now remaining, one is a suspension bridge built at Queenstown, seven miles downstream. The others are of the arch type and cross the gorge much nearer the Falls. One of them, indeed, is almost under the cataract itself, and carries a roadway that connects the towns on opposite banks of the river. The other two bridges carry the tracks of the Canadian National Railway and the Michigan Central Railroad respectively, and are situated two miles downstream.

The railway bridge owned by the Michigan Central Railroad Company is the most recent of those built at Niagara, and was completed in 1925, when it replaced a cantilever bridge that had been erected 42 years earlier. Although the older structure had been strengthened, it was quite unable to carry the enormous weight of modern locomotives, and was demolished soon after the completion of the new bridge. In some respects its disappearance is to be regretted, for it was interesting as the only cantilever structure among the 14 bridges that have been built across the world-famous gorge.

The new bridge is a handsome structure with a central span of 640 ft. This is flanked by two girder spans of 125 and 100 ft., respectively, which are hinged to the end frames of the steel arch, and rest on roller bearings on the approach piers in order to allow for expansion in hot weather. In general appearance the bridge is far more imposing than any previously erected at Niagara. Its great arch rises to a height of 207 ft. above the normal level of the river, and supports a track that is 20 ft. higher. In its construction 4,800 tons of steel were used, and altogether 7,500 tons were required to complete the structure. The floor of the bridge alone weighs as much as 1,250 tons!



Lowering the last section of the 640-ft. arch of Niagara's latest bridge. The box girder is being placed in position 207 ft. above the level of the river

In constructing an arch bridge it is of the greatest importance to secure a good foundation for the abutments on which the ends of the arch rest. There are four of these in the case of the Michigan Central Railroad Bridge, two on each side of the river, and a considerable amount of excavation was necessary before a reliable foundation for them was reached. A giant steam shovel removed 34,000 cu. yds. of earth and crumbling rock from the face of the cliff over a width of 150 ft. This exposed a layer of strong limestone, called the Clinton Ledge, which is about half-way between the top of the cliff and the level of the river, and it is this that actually bears the enormous thrust of the arch.

The material dug out on the United States side was simply dumped in the river, where it proved very useful in protecting the road that runs along the base of the cliff from erosion by the swift-running current.

Work on the construction of the abutments was then commenced. About 5,700 cu. yds. of concrete were used, and all four abutments were capped with concrete copings, each 2 ft. 6 in. in thickness, that considerably increase their strength.

When the abutments had been completed the next step was to place in position the cast steel shoes on which the ends of the arch are supported. These have the formidable task of transmitting the thrust to the foundation on which they are built. They are connected to the steelwork by enormous hinges, the pins in which are 19 in. in diameter. These pins pass through special castings, on which converge the ends of the arch and the vertical end posts of the bridge.

The task of erecting the arch and the steelwork supporting the floor of the bridge was then undertaken. The bridge is technically described as being of the two-hinged, spandrel-braced type. The curved arch, or " bottom chord " as engineers call it, consists of built-up box girders, 3 ft. in width and 5 ft. 6 in. in depth. The vertical girders have a " batter," or upward taper of 1 in 8, and support a heavily built top chord that comprises two channel side members with cover plates. It is horizontal, and the floor of the bridge rests on it. Each portion of the floor has been laid down separately to form an independent expansion section; thus it takes none of the stresses and strains of the bridge.

The steelwork was erected in a very interesting manner. Each half of the bridge was built out as a cantilever supported by a tie that ran backward into deep anchorage tunnels driven into the upper part of the cliff on each side. The tunnels were blasted with the aid of small charges of explosive, and some difficulty was experienced in driving them owing to the uncertain character of the rock. Water percolated through fissures at the rate of 40 gallons per minute, and it was necessary to keep pumps in constant operation while the work was in progress.

The mouths of the tunnels are 25 ft. below the top of the cliff, and have been driven to a depth of 99½ ft. on the United States side and 70 ft. on the Canadian side. They end in chambers, 20 ft. square and 13 ft. in height, which contain the heavy anchor girders, and were completed by grouting the fissures in the surrounding rock and laying pipes for the purpose of carrying the water away to a drainage sump.

The actual work of erecting the arch was carried out with the aid of a derrick car that ran on rails laid down on the floor of the bridge during construction. As each section, or panel, of the steelwork was finished, the derrick ran out on rails laid upon it, and the erection of the next was commenced. Strain gauge readings were taken, and elevations and alignments measured at frequent intervals in order to check them against the calculated values. So accurately was the work of erection carried out that, when the two halves of the arch were ready for closing, the end of the Canadian portion was only 2¼ in. on one side of that built out from the United States shore!

The completed half-arches were easily brought into line by means of two small jacks, and then remained the task of bringing together their ends. These were designed to meet on a 19 in. pin that formed the crown hinge, and closing the gap was a task that required very great care. Four powerful hydraulic jacks were used for this purpose. While the delicate operation was in progress the engineers stationed at various points were in telephonic communication with each other, and also with the man in charge of the pump that furnished the pressure to the jacks.

When the arch had been closed the centre posts were erected, and the final portion of the floor of the bridge was laid down. The last connection was to be made when the temperature was 60°F., as this was judged to be the average temperature experienced at Niagara. Accordingly the splicing material was attached on the Canadian side only, and the engineers postponed the actual joining until the correct temperature was reached, when the necessary holes in the plates on the United States side were drilled and filled with drift-pins. Later they were riveted up.

When the arch had been completed in this manner its joints also were riveted securely. There are no fewer than 30,000 rivets in the arch itself, all 1¼ in. in diameter and having a grip more than 5 in. in length.

The erection of the steelwork occupied practically six months, and the entire work of constructing the foundations and building the bridge was completed in less than two years at a cost of £440,000. The new bridge was opened for traffic on 16th February, 1925, and the work of taking down the cantilever bridge that it replaced was commenced immediately.

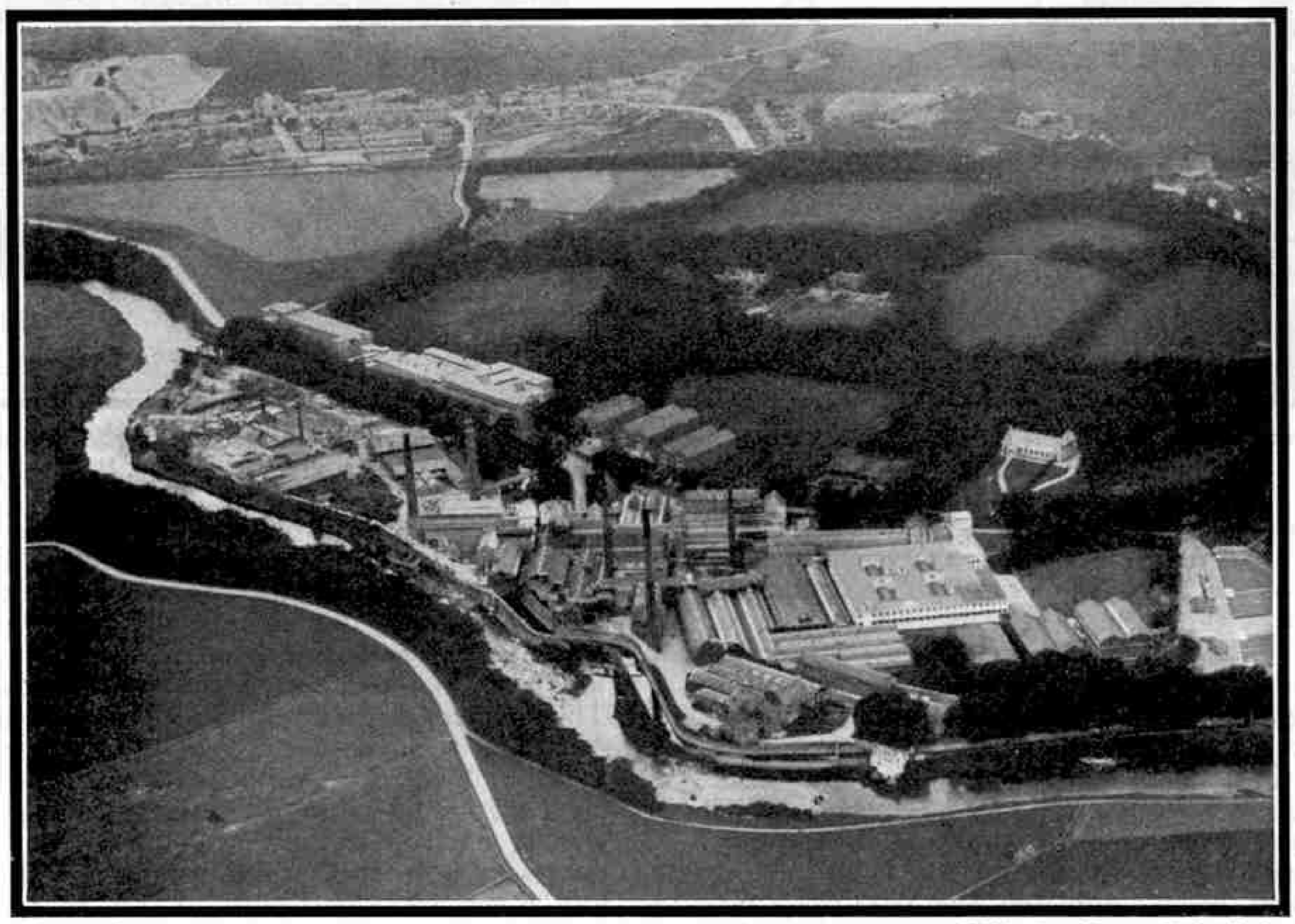
Arch bridges are invariably graceful and of pleasing appearance, and it is interesting to observe how this type has gained favour. For long spans the suspension bridge is most usual, and one wonders if there is any limit to the length that such bridges may have. At the present moment the longest is the Delaware Bridge at Philadelphia. This has a span of 1,750 ft., but it will be dwarfed by the mighty structure now in course of erection across the Hudson River. The distance between the towers that eventually will support the giant cables of this bridge is no less than 3,500 ft.!

There are certain difficulties in the way of the construction of arch bridges of this size, but within recent years two have been designed to have spans that not long ago were regarded as impracticable. These are the Sydney Harbour Bridge, and a bridge spanning one of the waterways near New York. When completed, these bridges will have spans 1,650 ft. in length.

Producing the "Meccano Magazine"

X.—THE STORY OF PAPER MAKING

In the earliest articles in this series we explained the preparation in the Editorial Offices of the copy for the articles that appear in the "*Meccano Magazine*," and described how this was set up on the wonderful Monotype. We also dealt with the preparation of the blocks used for the illustrations, and followed the course of the Magazine through the printing works as far as the proofing of the pages. The story of the production of the "*M.M.*" has thus been brought to the stage when all is ready for the actual printing of the thousands of copies required—except the paper. Of this more than twenty tons are required for every number! It is a very important link in the chain that connects the Editor of the Magazine with his readers, for without it the whole of the work already dealt with would be quite useless.



Courtesy] [*Wiggins, Teape & Co. Ltd.*

Aerial view of paper mill. A plentiful supply of pure water is essential, and mills are usually situated on the banks of streams

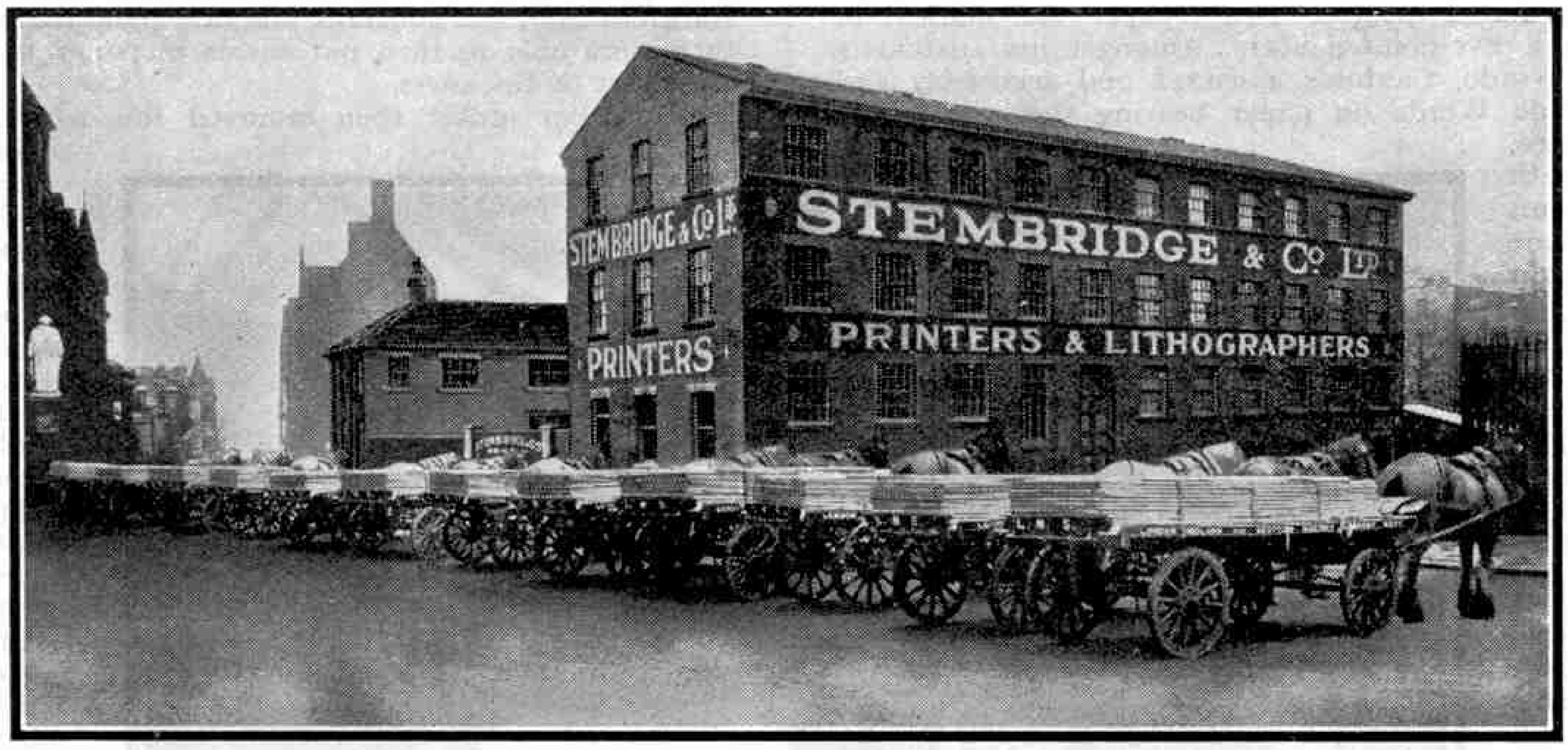
We are apt to take for granted a material such as paper. It is so familiar to us that we have difficulty in realising that there was a time when it did not exist, and that it is little more than 400 years since paper was first made in England. Even 100 years ago it was dear and was regarded as a luxury to be heavily taxed. The duty was abolished in 1860, and to-day paper is recognised as a necessity, and it plays a very vital part in human affairs. In fact, it is not too much to say that a supply of cheap and abundant paper is one of the chief requirements of our modern civilisation.

The savage races of prehistoric times expressed their thoughts in drawings or carvings on rocks and ivory, but with the coming of civilisation more convenient materials were introduced. In Babylonia and Assyria letters and books were "written" by stamping characters on tablets of soft clay and fixing them by baking. Records of this kind are of great permanence, and many that were made 6,000 years ago have been dug out of the mud and sand of Mesopotamia. To us, books consisting of slabs of clay would appear very cumbrous, but the Assyrians got along quite well with their strange writing materials, and have left voluminous records.

The first appearance of anything that resembles paper is recorded in Egypt, where papyrus came into prominence probably as early as 3580 B.C. Papyrus was made from a reed or plant of the same name that grows in profusion on the marshy shores of the Nile. It reaches a height of 10 to 20 feet, and the lower part of the stem often is as thick as a man's arm. The portion used by the Egyptians was the inner bark of the triangular stem. This was cut into long thin strips, which were laid side by side with their edges slightly overlapping. They were then damped with a sticky liquid—in later times the Romans used a paste made from flour for this purpose—and a similar layer of strips was laid across at right angles. The sheet was then pressed and dried in the sun, after which its surface was polished with a bone or a smooth stone. The object of the polishing process was to obtain a smooth finish, and also to make the material a little more compact in order to prevent the ink from penetrating too freely into it.

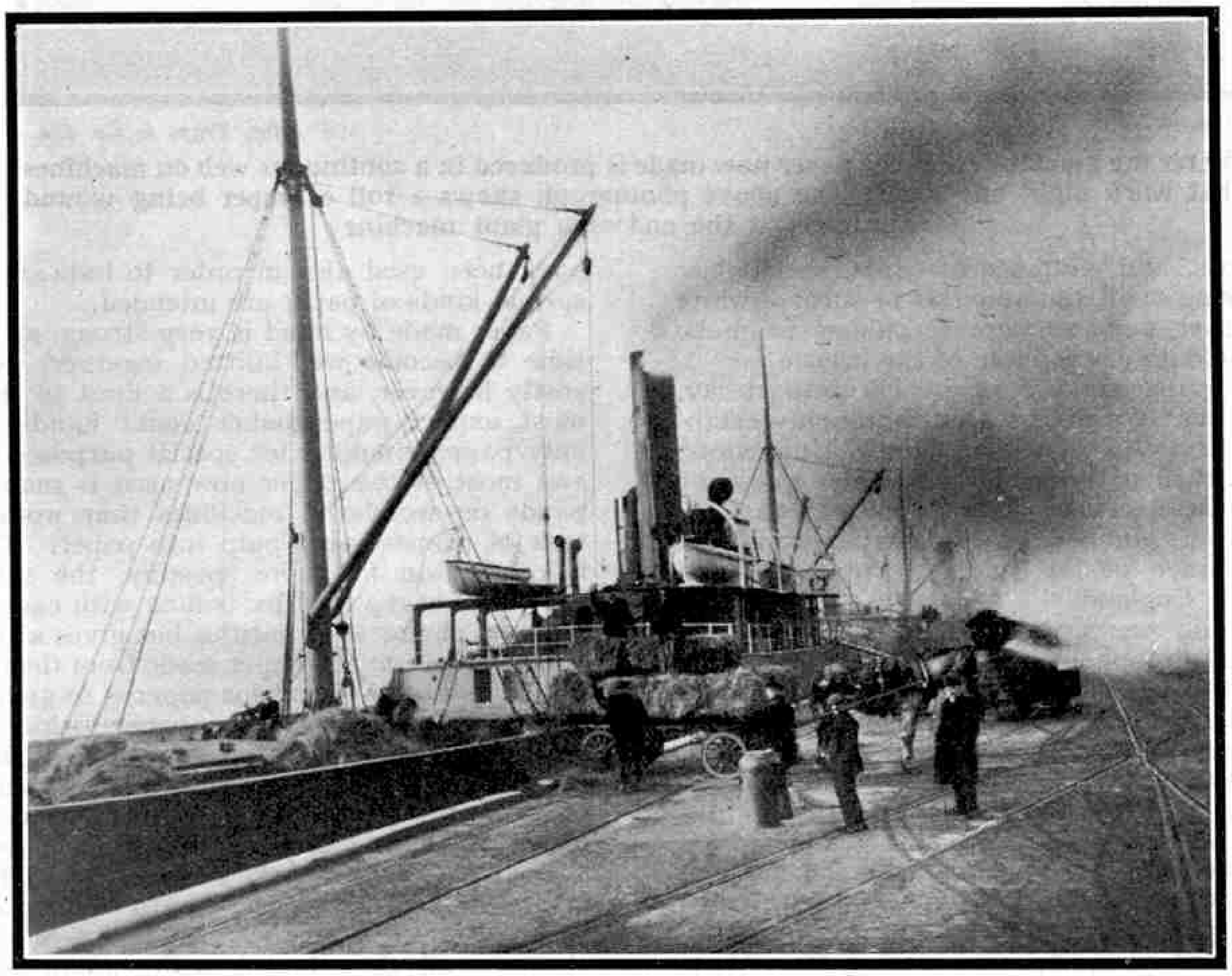
The use of papyrus spread from Egypt into most of the surrounding countries. These included Mesopotamia, but no records made on this material have survived in the damp climate of that region. The drier air of Egypt has been kinder to papyrus manuscripts and many have been recovered from Egyptian tombs, some being taken from the golden coffin of Tutankhamen. The early Greeks and the Romans also wrote on sheets or rolls of papyrus. It is interesting to find that "biblos," the Greek name for this material, survives to this day in the word used for the Bible, the most familiar and highly treasured of all books, the name of which simply means "The Book."

Presently a rival to papyrus appeared in the form of sheepskin, or parchment. It is said that an Asiatic king applied to the Egyptians for supplies of papyrus in order to enable him to form a library as extensive as that at Alexandria. The jealous Egyptians refused, and it was to supply the deficiency that the new material was invented.



Over 20 tons of paper are required for each number of the "*M.M.*," and our photograph shows the arrival of a month's requirements at our printers

Both papyrus and parchment were satisfactory in their way, and they remained in use for many centuries. In the meantime the discovery was made, thousands of miles away, that a suitable material could more cheaply and easily be made from linen rags. This was paper, for the appearance of which we are indebted to the Chinese, and it was entirely different from both papyrus and parchment. These valuable materials had continuous writing surfaces to begin with, and were merely improved by polishing during their preparation for use. The surface of paper, on the other hand, was made by the interlacing of the microscopic fibres in the pulp into which the rags were converted by grinding them with water.



Courtesy] [Wiggins, Teape & Co. Ltd.

Unloading esparto grass at the docks. This wiry grass from Spain and Northern Africa is very largely used in the production of British-made paper

It is said that the invention of paper was due to a Manchurian peasant, who had observed how wasps chewed wood and other vegetable products in order to felt their fibres into sheets of material suitable for nest making. However the discovery was made, the Chinese, as early as 95 A.D., had learned how to make paper from the inner bark of the bamboo, and they afterwards used cotton, linen and silk rags for the same purpose.

For many centuries the Chinese kept the art secret, and it was not until Arabian invaders penetrated into Central Asia that knowledge of paper-making spread to the West. In 704 A.D. the Arabs captured Samarkand, a famous trading centre on the caravan route to China and India, and from some of their captives they learned the use and manufacture of paper. The new art spread rapidly, and Damascus became an especially important centre for its production. Many Arabian manuscripts of the 9th century are still in existence, and most of them were written on paper manufactured in that city, and known as "Charta Damascena." Other famous mills existed in Bagdad.

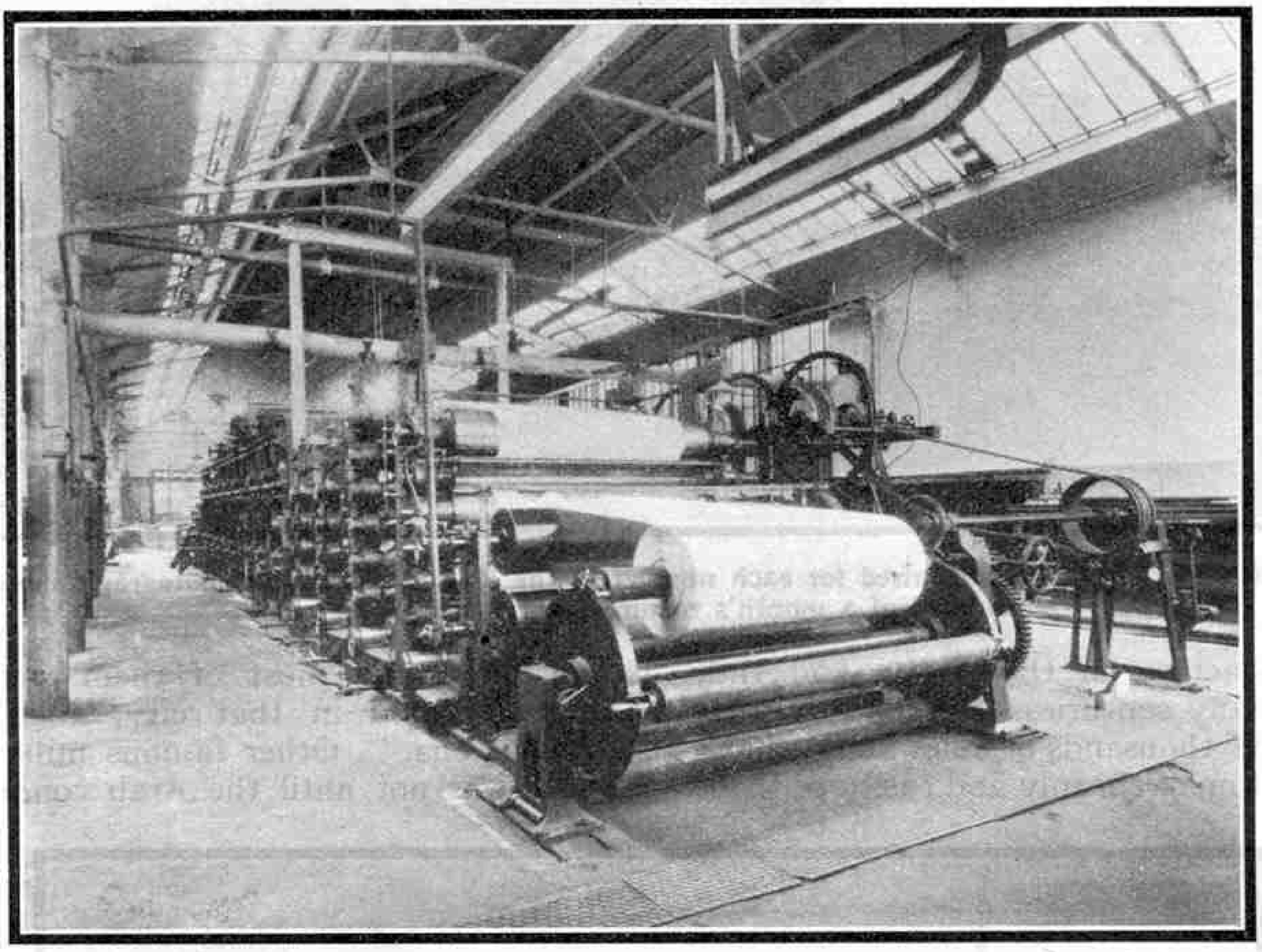
It was not until the Arab conquests extended westward into Spain that the manufacture of paper was commenced in Europe. Some paper had already appeared there, but until the 12th century the chief writing material used was vellum, a fine parchment prepared from the skins of lambs, sheep and calves. The parchment thus made was very durable, but unfortunately was very expensive. This resulted in such practices as erasing the writing on old manuscripts in order to replace it with new matter. This was carried on to a great extent, and has been the cause of the loss of many precious ancient manuscripts, that to-day would have been highly treasured.

The first recorded paper mill in Christian Europe was set up in the Pyrenees in the year 1189. By 1276 the secret had spread to Italy, and it was from this country that most of Europe's paper supply during the 14th century was obtained, although there were also mills in Germany and in other countries. The resulting increase in the supply of paper was fortunate, for it brought a useful writing material within the reach of a very large number of people, and there is little doubt that its introduction was one of the steps that hastened the invention by Johann Gutenberg of the use of movable types.

The first English paper mill of which we have any knowledge was erected in 1494 at Stevenage, Hertford, by John Tate, who was the son of a Lord Mayor of London. Water-marking already had been introduced and most of Tate's paper was marked in this manner with a five-pointed star. Amongst his customers was Wynkyn de Worde, Caxton's assistant and successor, and books printed by de Worde on paper bearing this watermark are still in existence.

After Tate's death very little paper seems to have been made in England for about 100 years. Then, in 1588, a German named Spielman built a mill at Dartford in Kent. His business prospered, and before long the number of employees had risen to 600. The mill was visited by thousands of curious people, who were eager to see how paper was made. Among these visitors was James I, who seems to have been greatly impressed, for in 1605 Spielman was knighted.

The paper made at Dartford is supposed to have been very coarse. This would not be surprising if Spielman used all the raw materials mentioned in his licence to manufacture paper! The document empowered him to gather "all manner of linnen, raggs, scrolls or scraps of p'chment, pease of lymes, and clippings of cards, and oulder fishinge nettes, for the making of all and anie sort or sorts of white wrighting paper." All other persons were forbidden to make paper for 10 years after the date of the issue of the licence.



Courtesy] [*Wiggins, Teape & Co. Ltd.*

By far the greater part of the paper now made is produced in a continuous web on machines that work night and day. The above photograph shows a roll of paper being wound on the reels at the end of a giant machine

After Spielman's time, paper-making again fell into decay, and it was not until 1685 that the art became thoroughly established in this country. In that year a large number of Huguenóts, or French Protestants, left their native country in order to escape persecution, and many of these refugees found their way to England. Among them were a number of skilled paper-makers, and these took full advantage of the splendid opportunity of introducing their trade into England.

At that time paper-making was a very slow process, and the only machinery in use was extremely crude. Cotton and linen rags were the chief raw materials, and the first step in transforming these into paper was to reduce them to a pulp by beating in water. In order to bring this about the rags were wetted, rolled tightly into balls, and left in heaps to ferment for about six weeks. When this process had gone far enough the rags were immersed in water and pounded by heavy wooden rods. In this manner they were torn and disintegrated into fragments, and the pulping was completed in tanks in which the beaters were shod with nails.

In many mills the pulp passed through as many as six of the troughs or pans in which the pounding was carried on. These were lined with iron or brass and a constant stream of clean water passed through them. The crude stamping mills were worked by water power, and in 24 hours only 1 cwt. of rags could be macerated by 40 pairs of stampers. After many hours of pounding, the cotton and linen fibres were thoroughly separated. The pulp then was diluted with water to make it of any desired consistency. It will be seen that paper-making requires large quantities of water, and it was for this reason that all paper mills were built on the banks of streams that served the double purpose of driving the machinery and providing water to dilute the pulp.

The first step in the actual making of a sheet of paper consists in draining away the water in the pulp and leaving the fibres felted together. This was done in a shallow mould, the bottom of which was made of wire cloth, a loose wooden framework called a "deckle" forming the sides. The workman dipped the mould in the vat and took up sufficient pulp to form a sheet of the required thickness. A gentle shake sideways, followed by one forward, distributed the pulp thinly over the mould. In the meantime the bulk of the water ran through the wire cloth, leaving the fibres behind in the form of a thin sheet. This task called for great skill, but constant practice made the men so expert that they were able to turn out sheets of paper that scarcely varied in weight or thickness.

The paper maker then removed the deckle, and passed the mould to a workman called a "coucher." By him the newly-formed sheet of paper was transferred to a strip of felt. When a sufficient number had been obtained the coucher made a pile of alternate layers of paper and felt. This was pressed in order to squeeze out superfluous water, and the sheets of paper were then separated and hung in a drying loft.

Practically all hand-made papers bore a watermark. In order to produce this, wires forming the letters or design required were raised above the rest of the wire cloth. The paper formed above these wires was thinner, and the design could be distinguished when the sheet was held up to the light. Watermarks were introduced in order to distinguish between the products of different paper mills, and they have been used also in order to indicate the purposes for which special kinds of paper are intended.

Paper made by hand is very strong, as the fibres have sufficient time to become well-knitted together. The process is slow and costly however, and there is a limit to the size of sheet that the most expert paper-maker could handle. At the present time only paper intended for special purposes is made in this manner, and most of the paper now used is manufactured in continuous bands on wonderful machines that work night and day at the task of transforming pulp into paper. The making of pulp also is carried on far more speedily, the slow fermentation process having been replaced by boiling with caustic soda. This not only removes chemical impurities but gives a soft texture to the fibres, and therefore to the paper made from them.

The modern demand for paper is so great that it has been found necessary to search for new paper-making materials, and esparto, straw, bamboo, and the woody fibre of the sugar cane have been pressed into service. By suitable treatment the microscopic fibres of these substitutes for rags readily may be brought into condition for felting into paper. Esparto is of special interest, as it has been very largely used in Great Britain. This tall, wiry grass grows in Spain and North Africa, and arrives at the mills in large bundles, bound with hoops or esparto rope. It is first cleaned and then boiled with caustic soda, which softens the grass and reduces its bulk considerably. Afterwards it is beaten into pulp, and bleached in readiness for actual paper-making.

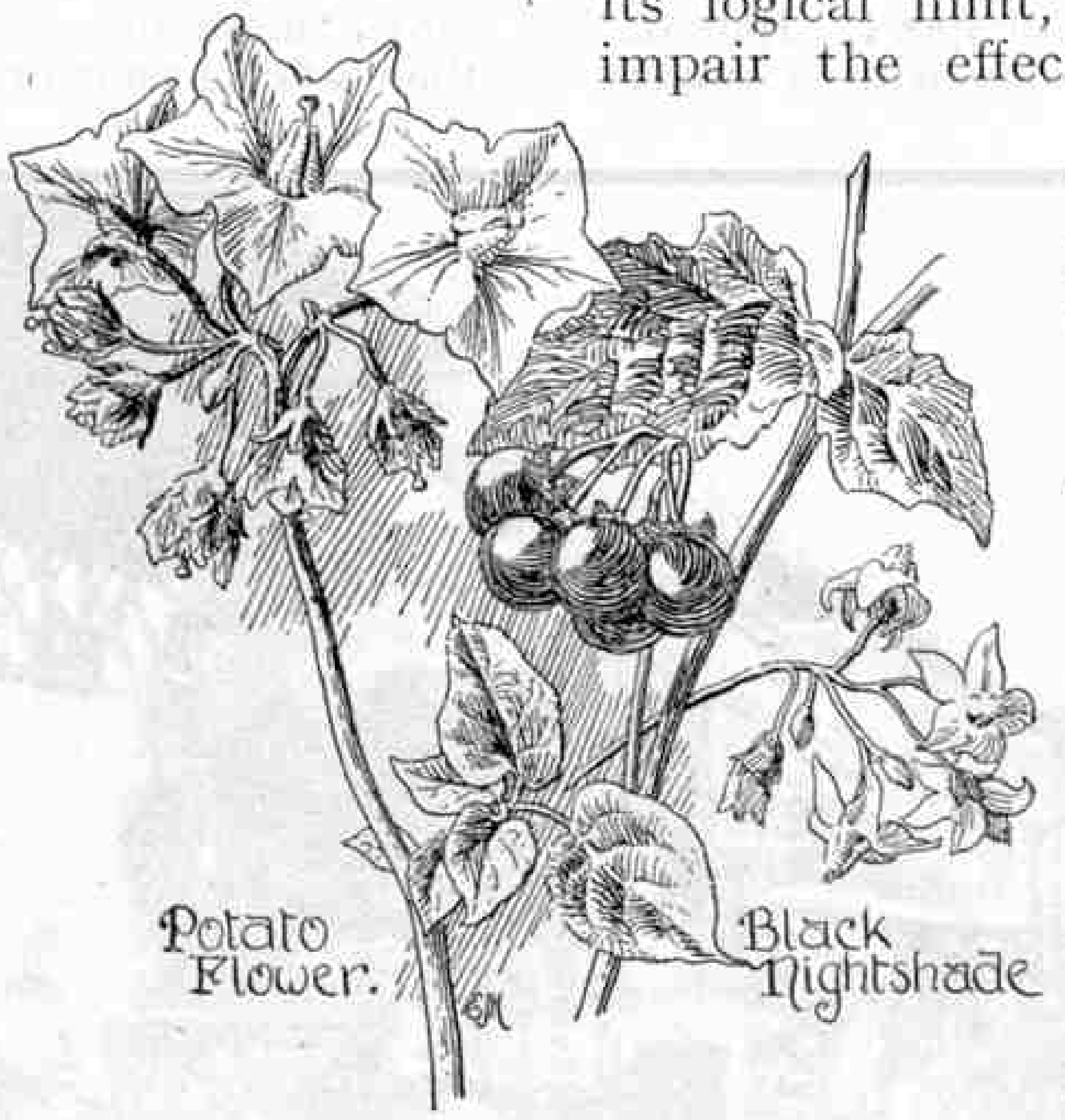
Even with the use of these substitutes paper-makers have been unable to keep pace with the demand, and it has been found necessary to make use of wood, which is now the premier paper-making raw material of the world. Pulp made from it may be used in the manufacture of all grades of paper, from ordinary wrapping paper to the high-class, smooth-surfaced kind used in printing the "*M.M.*"

The story of the transformation of logs into paper is one of the romances of modern industry, and we shall explain how this is accomplished in next month's article.

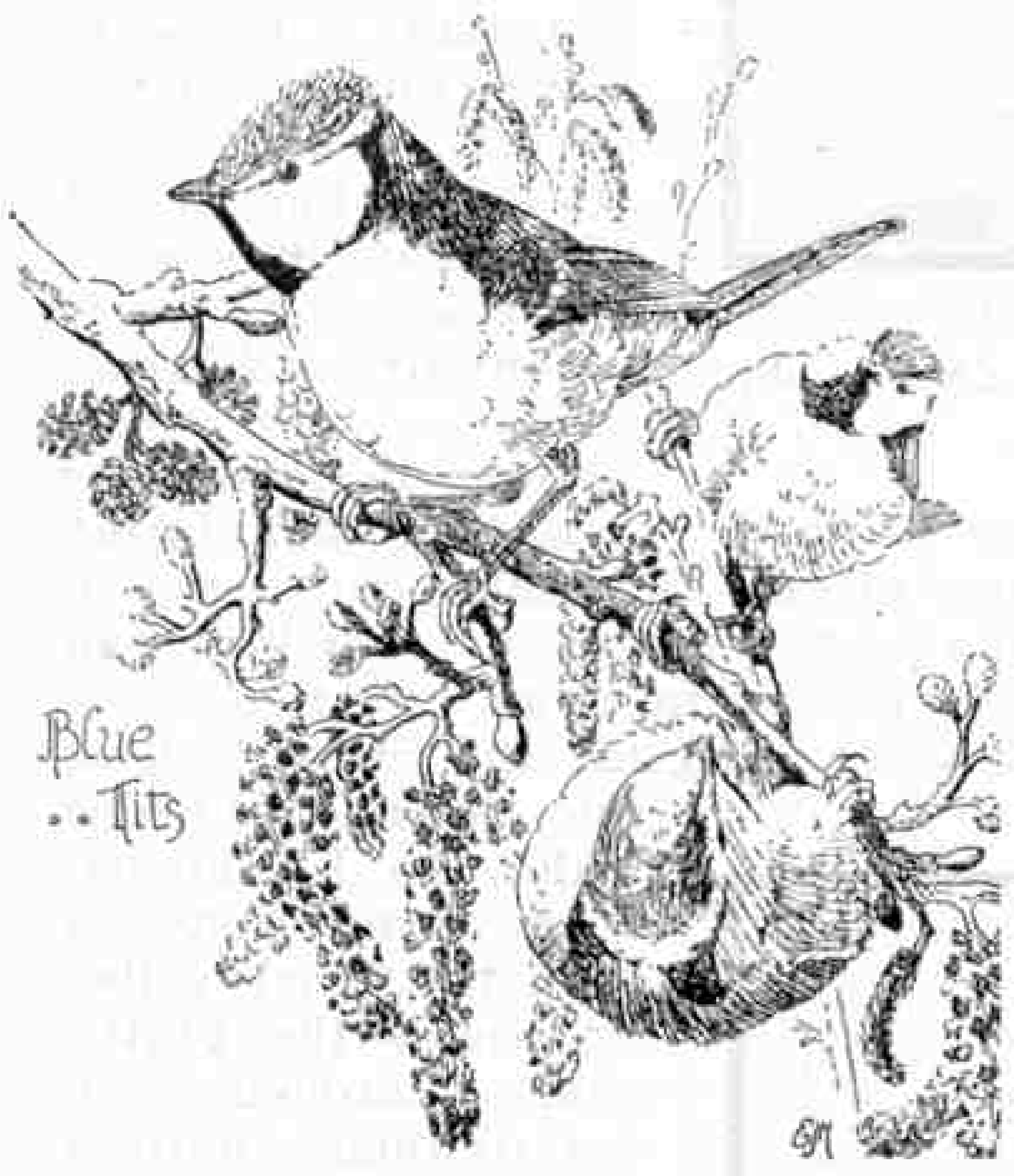
Lifelong Invalid's Love for Nature

Passing of an "M.M." Contributor

MANY readers will remember the articles on various natural history topics by Mr. Eric J. Helsby that have appeared in the "*M.M.*" from time to time during the past two or three years. Prominent among these articles was one entitled "*A Family of Acrobats*" that appeared in the issue for June 1926, and which was illustrated by several of Mr. Helsby's very beautiful drawings of birds of the tit family. Then again there were the articles in the March and April 1927 issues dealing with the poisonous plants of our hedgerows, and also illustrated by several beautiful pen and ink sketches. Readers who recall these delightful articles will regret to hear of the death of the author within two months of his twenty-seventh birthday.

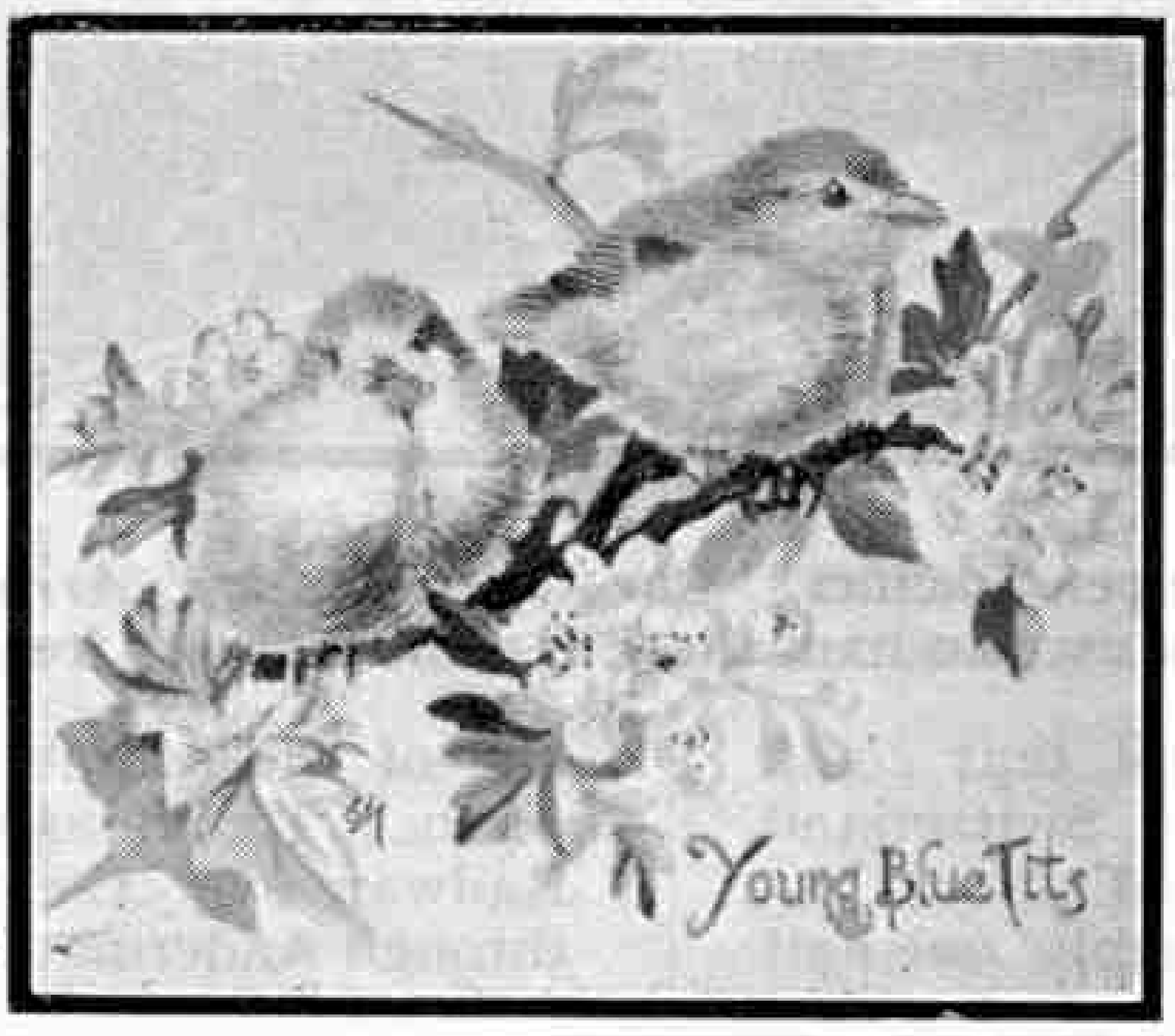


Mr. Helsby's life was very sad, and it afforded a remarkable illustration of a gifted and lovable nature triumphing over years of pain and suffering. When he was six years old he was caught in a heavy thunderstorm while on his way to school and was soaked to the skin. Through someone's neglect he was allowed to remain in his wet clothes, and rheumatic fever followed, with many weary months of pain. From the effects of this illness he never recovered. His young limbs never developed, and throughout the remainder of his life he lay helpless upon his back.



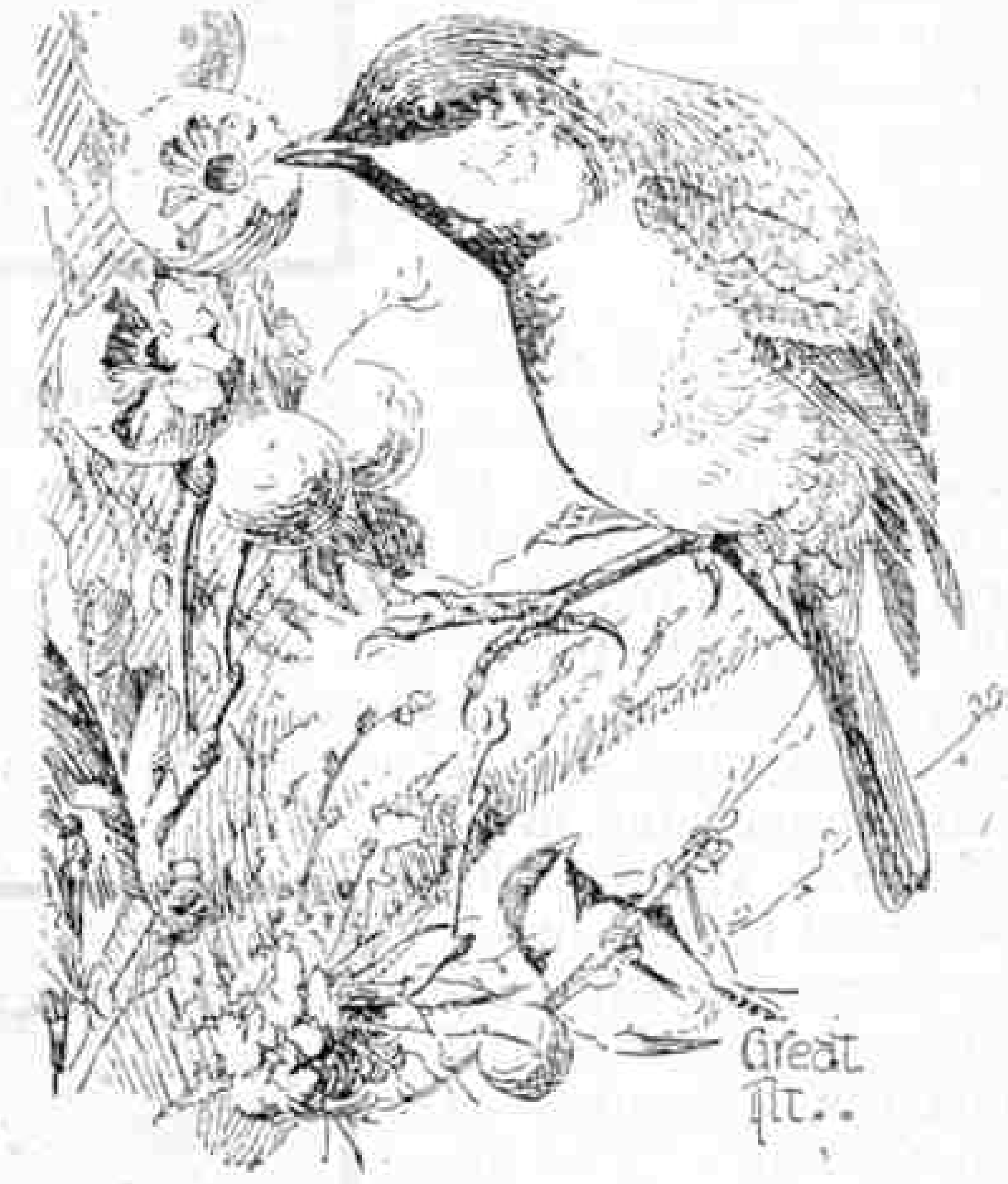
His great interest lay in natural history, and he taught himself to make wonderfully accurate and beautiful pictures of trees and flowers. Birds made a great appeal to him also, and as far as possible he studied them by the aid of a telescope as he lay in his invalid chair in his little cottage garden.

Nobody who had seen the tiny wrist and poor little twisted fingers could ever have imagined that they could produce drawings of such exquisite finish. There is about them an admirable delicacy that conveys "atmosphere"—always a most elusive quality. It has been said of drawing that the great thing is "knowing what to leave out." That knowledge is clearly shown in all Mr. Helsby's sketches. Detail is carried out to its logical limit, and anything more—or less—would impair the effectiveness of the drawing.



All birds appealed to Mr. Helsby, but he seems to have been specially fond of the quaint members of the tit family. The extraordinary acrobatic performances in which they indulge when in search of insect food never failed to delight him.

As Mr. Helsby could not go to his bird friends, he had to induce them to come to him. This he accomplished by arranging for a daily supply of food to be provided for them, not only during the winter months when natural food is scarce, but throughout the summer. Many people seem to think it is useless to tempt birds with food in summer, but that is a mistake. Birds soon form the habit of coming day by day to see what dainties have been provided for them. Even when food fails to tempt them, they will come regularly in hot weather for a bath if one is provided for them in an old pie dish or similar vessel, and no one can fail to derive both pleasure and amusement from their happy splashing.



The delicacy of Mr. Helsby's drawings has already been referred to. There is also another feature about them that deserves mention, and that is the impression they convey of real sympathy. One feels that the artist really loved his small "sitters" and appreciated their various individualities.

Mr. Helsby had still another talent, that of music. He was, of course, utterly unable to attempt to play any kind of instrument, but he taught himself the elements of harmony and composed a number of little tunes of considerable excellence.

One often hears the hackneyed phrase—"the triumph of mind over matter"; but seldom does one find so striking an example as that afforded by Eric Helsby. He never lost courage despite his great handicap, but just smiled his way along to the end.

FAMOUS TRAINS: XXVII

The Engadine Express

By Cecil J. Allen, M.Inst.T., etc.

THIS month we are to go for a sightseeing trip over one of the most spectacular railway routes in Europe, rather than to note any exceptional feats of load haulage or speed. Indeed, such feats could hardly be expected over a line with a ruling gradient of 1 in 29, and constant and very sharp curves—over a route where the railway has to travel for 7¾ miles to cover a distance which, in a bee-line, is but 3½ miles, in order to overcome a difference in level, up one mountain valley, of over 1,300 ft. In addition, this has to be done over a gauge of one metre, instead of the 4 ft. 8½ in. gauge to which we are accustomed. But I am anticipating.

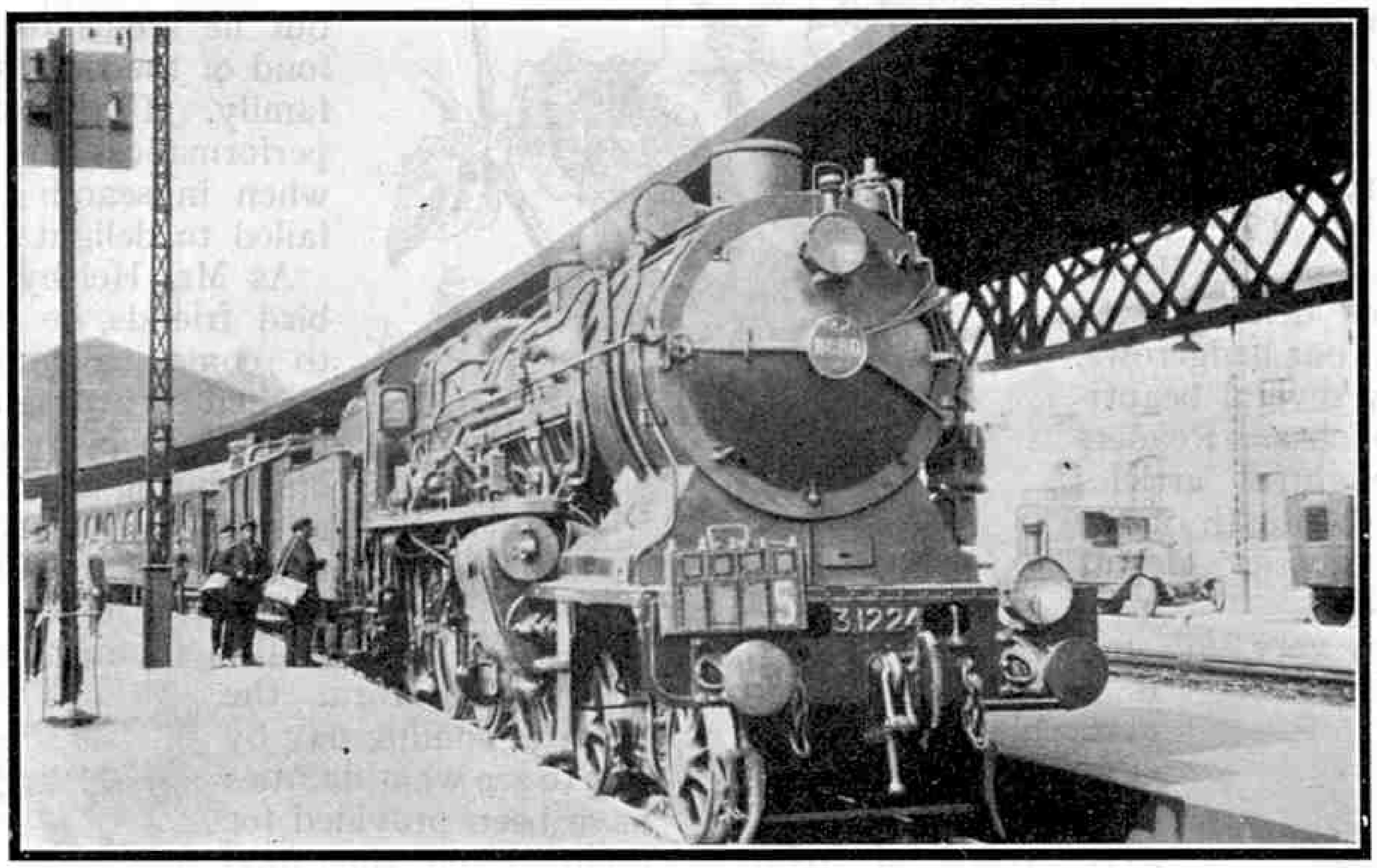


Photo courtesy] [W. H. C. Kelland

Super-Pacific 4-cylinder compound express locomotive No. 3.1224 Chemin de Fer du Nord of France

First of all, where is the Engadine? The name has been given to the easternmost big valley in the easternmost Canton of Switzerland. The river, that flows through it—the Inn—is the one Swiss river whose waters flow to the north-east, to fall into the Danube at Passau in Austria, and travel on ultimately to wash the shores of the Bolsheviks in the Black Sea. But it is not for this reason that the Engadine has become famous. It contains those well-known holiday resorts, St. Moritz and Maloja, which are as popular in mid-winter as in mid-summer, and, in an adjacent valley, the beautiful Pontresina—to carry British passengers to which the Engadine Express is chiefly run. The attraction of the valley lies in the fact of its tremendous altitude. St. Moritz and Pontresina are both roughly 6,000 ft. above the sea, and their incomparably pure air is a tonic that annually lures thousands of happy holiday-makers to this playground of Nature. But it is this attractive altitude that at the same time has made so extraordinarily difficult the task of the engineer in giving access to it by rail.

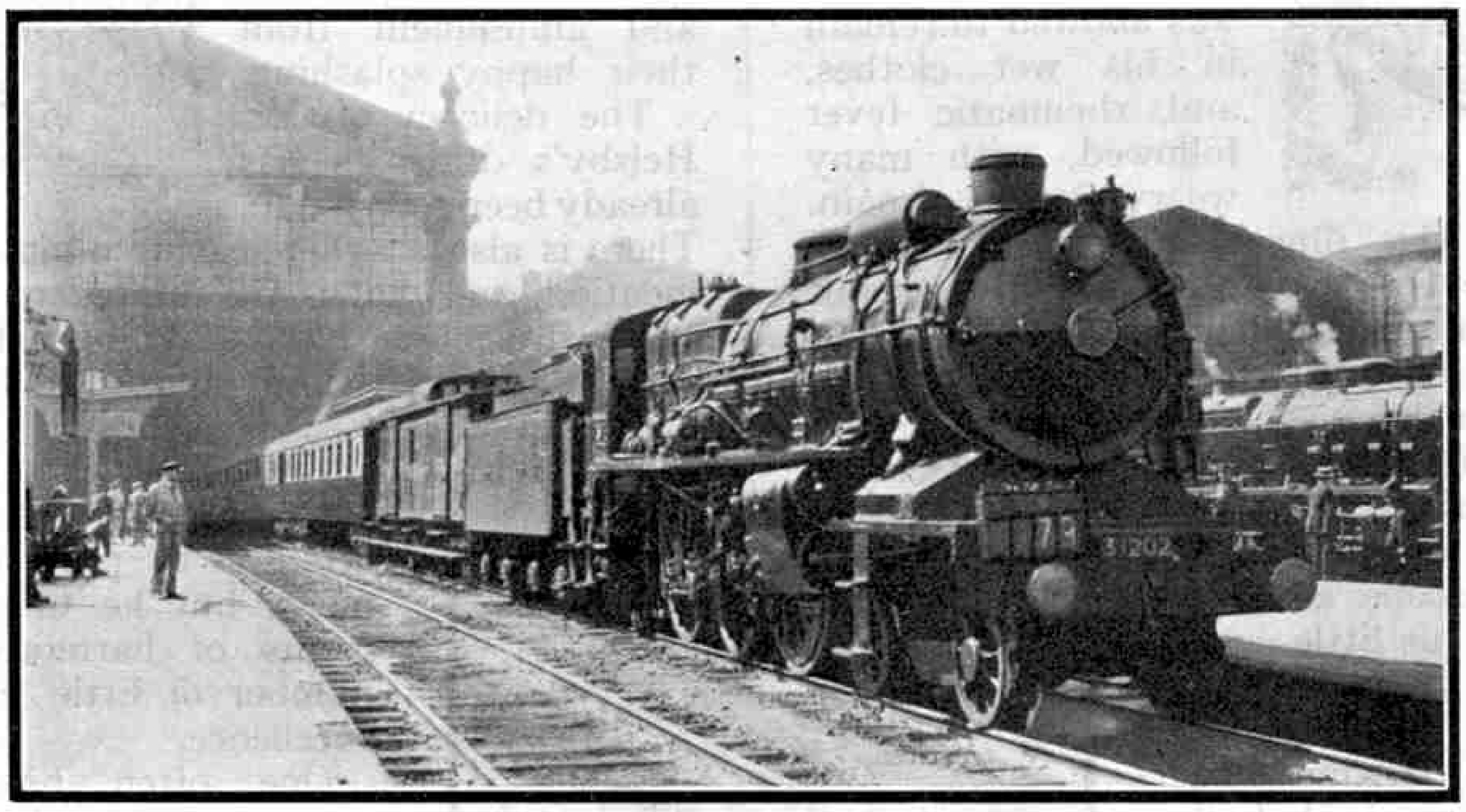


Photo courtesy] [W. H. C. Kelland

Another of the Nord "Super Pacifics," on the "*Golden Arrow*" at Paris (Nord). An engine of this type is used to haul the Engadine Express from Boulogne to Laon

Except, possibly, for the broad valley of the Aar, there is barely a square mile of Swiss soil that could be described as other than mountainous. But if Switzerland generally is mountainous, the easternmost Swiss Canton, the Grisons, is so in a most exceptional degree. Roughly one-half of the 2,775 square miles of its area consists of high mountains, for the most part glacier-covered. The remainder is divided into a maze of some 150 valleys, many of them nothing more than wild chasms or gorges, and the most forbidding of territory from the railway point of view. In fact, so difficult was the intervening country, that for many years the Swiss thought it out of the question that St. Moritz could ever be connected by railway with Coire or Chur, the capital of the Canton, served by a lengthy branch of the main Swiss Federal system coming up the Rhine valley. It was left to a German engineer named Hennings ultimately to show them the way.

The railway network known as the Rhaetian Railways now connects Coire directly with St. Moritz, and has reduced what was previously a journey of 13 hours by horsedrawn *diligence* to one of just under 2½ hours in smoothness and comfort by the Engadine Express. It is true that during this period we cover a distance of only 55½ miles, but we shall see presently over what kind of a route this is done. The Rhaetian Railways have extended their tentacles in other directions also. A loop route starts out from Coire alongside the Swiss Federal line down the Rhine Valley to Landquart, then turns eastward into the deep valley known as the Prattigau, through an extraordinary natural gateway in the mountains rightly called the "Klus," or key. Ascending this valley to Klosters, it then climbs high up the mountain side and over the ridge into the valley in which is situated another famous resort—Davos—whence it descends to join the main route previously mentioned at Filisur, ere the spectacular ascent of the Albula Valley is begun.

Another branch ascends the valley of the Vorder Rhein—one of the sources of the great Rhine—from Coire to Disentis, whence it is continued by the newly-opened Furka-Oberalp Railway over the 6,720 ft. Oberalp and 7,100 ft. Furka Passes through Andermatt to Brigue, at the mouth of the Simplon Tunnel, in the Rhone Valley. It is thus now possible to make a journey by metre-gauge train halfway across Switzerland, in a through coach from St. Moritz to Brigue; and, more extraordinary still, from a valley whose waters are flowing to the Black Sea, through several valleys whose waters will reach the North Sea, into one that drains into the Mediterranean!

The third Rhaetian branch runs down the Inn Valley northeastward from St. Moritz to the well-known spa of Schuls-Tarasp, whence it may be extended some day across the nearby Austrian frontier to join the Arlberg main line at Landeck.

Altogether the Rhaetian Railway authorities, with rare enterprise, have laid just over 170 miles of railway through this terribly difficult Canton. It is entirely of metre gauge, which, although at the expense of speed and carrying capacity, makes it possible to use sharper curvature, so that cutting and embanking can to some extent be kept down by the track closely hugging the irregular mountain sides. Even so, much heavy engineering work has been necessary, including 81 tunnels—one of them 3¾ miles in length and at an altitude of 6,000 ft. above the sea—and 407 bridges or viaducts, some of them of astonishing size.

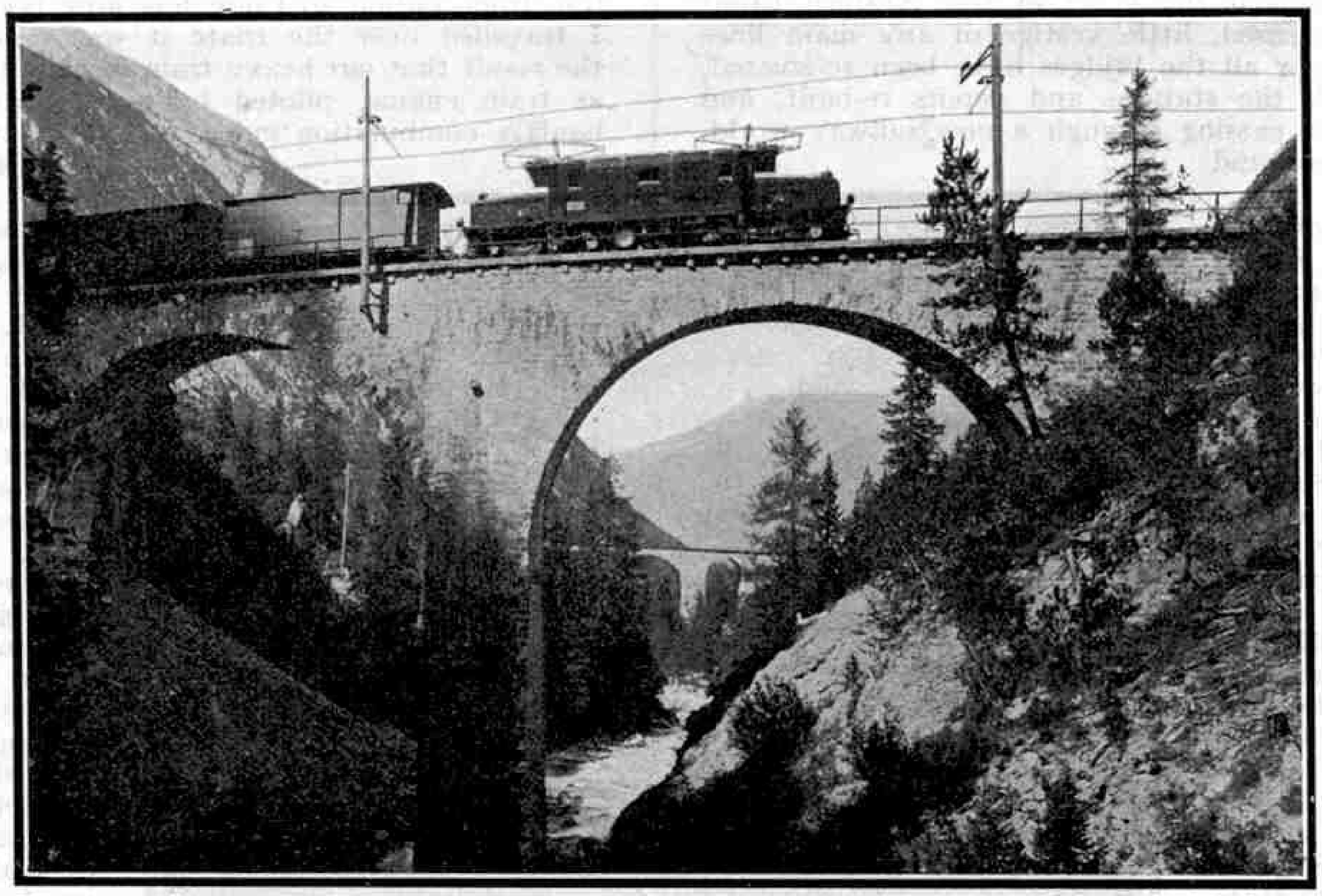
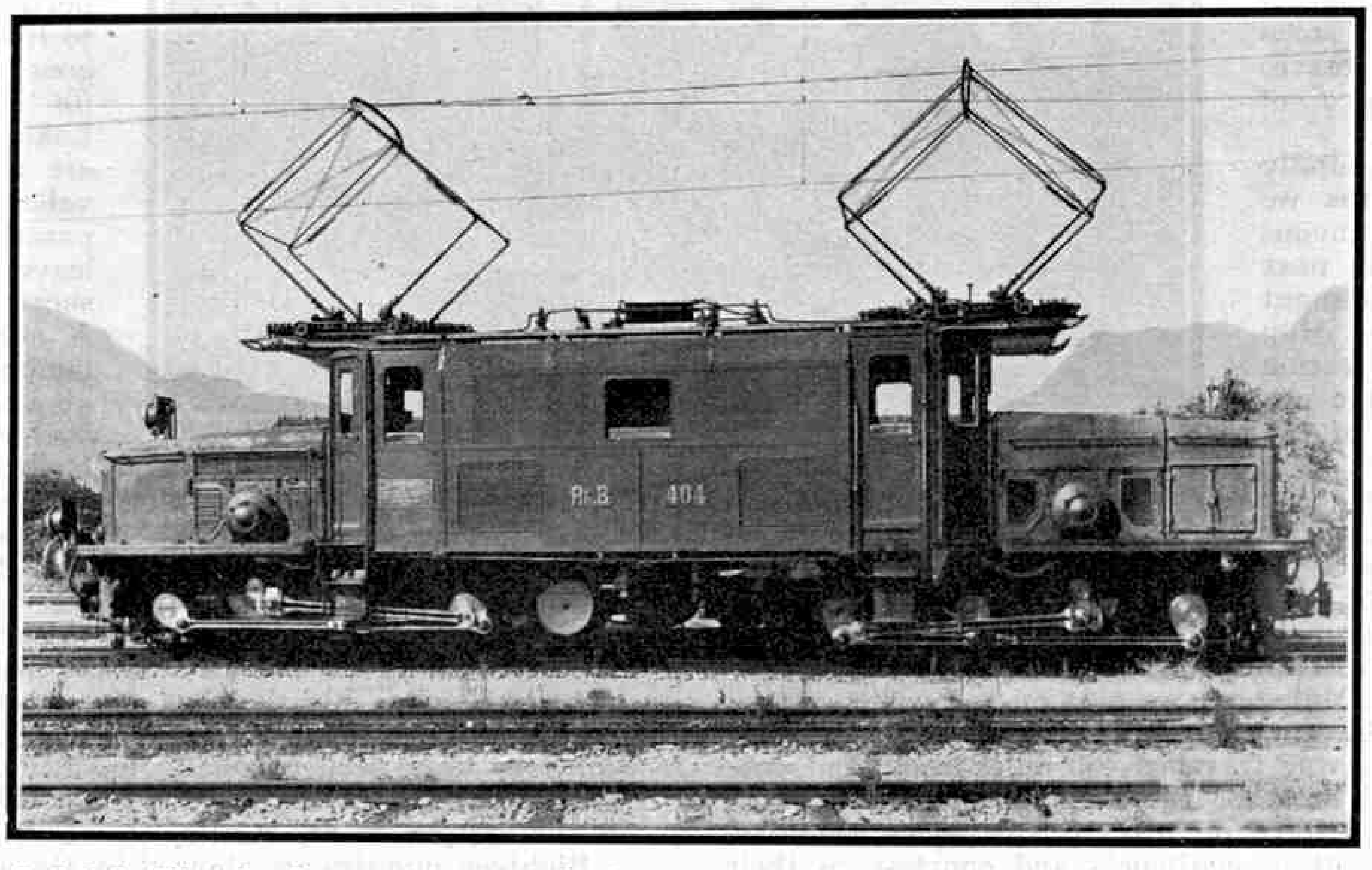


Photo courtesy] [*Swiss Federal Railways*

The Engadine Express ascending the spirals in the Albula Valley, Rhaetian Railways

But before we can travel on the narrow-gauge Engadine Express we have to see something of the standard gauge Engadine Express that is to carry us luxuriously across Europe from Boulogne to Coire. We must therefore get ourselves and our baggage to Victoria in good time to catch the "14.00" boat express for Folkestone. Our British division of the day into two halves, instead of the sensible Continental 24-hour system of reckoning time, makes this two o'clock in the afternoon. A Southern "King Arthur" will hurry our substantial train—consisting of 6 or 7 corridor coaches, probably three Pullman cars, and one or two brakes—down to Folkestone Junction, where we shall run through into the sidings beyond the station. Here a couple of diminutive 0–6–0 tanks will attach themselves to the back of the train and lower us cautiously down the 1 in 42 gradient to Folkestone Harbour Station, where we are due at 3.40 p.m. We shall hope to find the Channel in a kindly mood, and after about an hour and a half we ought duly to discover ourselves alongside the quay at Boulogne, whence we pass through to our waiting Swiss express.



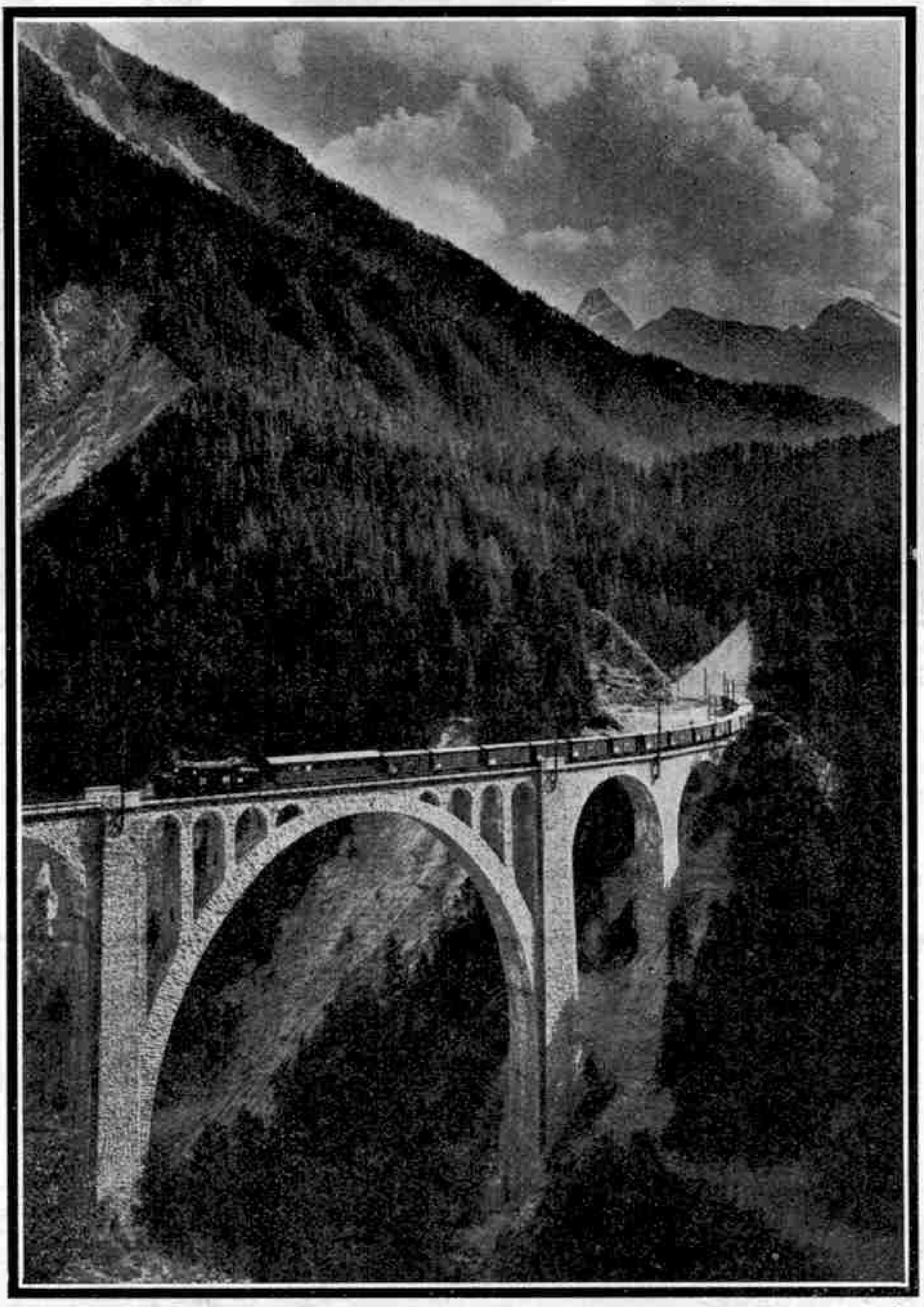
0-6-6-0 Electric locomotive, used for hauling the Engadine Express over the Rhaetian main line from Coire to St. Moritz

It is a "Blue" train, and so will immediately arouse the interest of every Hornby Railway Company enthusiast. Now that the "*Blue Train*" proper (from Calais to the Riviera, which is run on Mondays, Wednesdays and Fridays only), has become a "super-Blue Train," with new and very magnificent rolling stock, the familiar blue sleeping cars are being used on many other services, this one included. We note with pride, as we did in the case of our "*Golden Arrow*" journey, that, when the French want the finest rolling stock that can be built, they come to England for it, as the makers' name-plates on the coaches bear witness. Our train is composed entirely of sleeping cars, with a big restaurant car and one or two vans, and the little white destination boards on the sides of each car provide an interesting study.

We soon find our own cars, labelled "Boulogne - Coire"; next to them are cars bearing the inscription "Boulogne - Arlberg - Vienne," which will keep us company until we are within 16 miles of Coire. Then, again, there are through sleeping cars for Interlaken, in the Bernese Oberland, which we convey to Belfort, in Eastern France, where they leave us to cross the frontier at Delle, making straight for the Swiss capital of Berne, while we are running on to Basel. Not only is our express first-class only, but a handsome supplement is charged in addition for the use of the palatial sleeping cars, so that this is not going to be a cheap journey. But a trip by a Continental *train-de-luxe* is certainly the essence of comfort.

The first train away from Boulogne after the arrival of the boat is the ordinary express for Paris, which leaves at 5.53 p.m. We are due to start nine minutes later, at 6.2 p.m. There is little doubt that the engine of our heavy express, whose formation in the height of the season may turn the scale at anything from 500 to 600 tons, will be one of the famous super-"Pacific" type of the Chemin de Fer du Nord. The amazing exploits of these engines have been described more than once in these columns. Suffice it now to say that with 500-ton trains they constantly maintain average speeds of round about 55 m.p.h. up continuous 1 in 200 gradients—like the climb of the L.N.E.R. main line from Wood Green to Potter's Bar on the north side of London—and travel along the lengthy stretches of level track between Etaples and Amiens for mile after mile at 70 miles an hour. Yet each of these engines weighs, without tender, 96 tons, or almost exactly the same as one of the "super-Pacifics" of the latest "Flying Scotsman" type on our own London and North Eastern Railway.

We have travelled previously over the main line of the French Northern Railway, when we flew from Calais to Paris by the "*Golden Arrow*." After passing slowly through the "Ville" station at Boulogne, we join this route at the "Bifurcation d'Outreau," or Outreau Junction, as we should call it. We then follow the same course through Etaples and Abbeville to Amiens, where we diverge to the north, as we are to avoid Paris altogether by taking a more northerly route through Laon and Rheims. The most interesting features of this part of the journey are the remarkable feats of reconstruction that have been carried out by the Chemin de Fer du Nord authorities since the Great War. Here we are passing through the heart of the Western Front where, when hostilities ceased, little vestige of any main lines of railway remained. Now all the bridges have been re-erected, all the tracks relaid, all the stations and depots re-built, and to the traveller it is like passing through a new railway world, all equipped in the latest and most modern fashion.



Courtesy] [*Swiss Federal Railways*

The great Wiesen Viaduct of the Rhaetian Railways near Davos

During this part of the journey we have been dining very comfortably in the palatial British-built restaurant car, and the next part of the proceedings will be to get to bed, as we have a great deal to see to-morrow and must keep ourselves as fresh as we can. Before retiring, however, we must see the change of engines at Laon, as here we cross a railway "frontier"—from the system of the Nord to that of the Est. Our new locomotive is probably of the 4–6–0 type, the Est management never having favoured the "Pacific" type to the same extent as the other French railways, though they have a few "Pacifics" of a standard design that were built for general French railway use just after the War. Laon is reached exactly at 9 p.m., and we leave again at 9.8 p.m. Owing to its weight, this train is not timed at so high a speed across France as the special Swiss night express, in connection with the 4 p.m. service from London, which is booked to average over 50 m.p.h., stops included, from Calais across to Belfort, a total distance of 435 miles.

While we are sleeping soundly in our comfortable berths we are hurried on through Rheims to Châlons, which is the next stop, and then to Chaumont and Belfort, where we drop the Bernese Oberland section of the train and exchange our Est locomotive for one of the Alsace-Lorraine Railways, over whose territory we have now to pass. One of the benefits of the war to the traveller is that it is no longer necessary to pass through a corner of Germany between Belfort and Basel, so that the customs examination in the middle of the night at Petit-Croix is fortunately a thing of the past.

With one more call, at Mulhouse, we pass on to Swiss territory and find ourselves in the great Central Station at Basel at 5 o'clock in the morning, having travelled 460 miles from Boulogne. Over an hour is allowed here, for the Customs officials have to visit us—though we need have no fear, as the Swiss *douaniers* are always the embodiment of gentleness and courtesy in their attentions. Through sleeping cars for Vienna and Coire have to arrive from Paris, to be attached to our train. So it is 6.10 in the morning before we get away again, feeling, no doubt, quite ready for the enticing breakfast of crisp rolls, real Swiss butter and steaming coffee that is served in our restaurant car on the next stage of the journey.

This is at the outset up the wide Rhine valley, but presently, at Stein, we turn up a branch valley, tunnel for 1½ miles under the crest of the ridge at Effingen, and drop down to the valley of the Aar, with our first distant view of the snowclad Alps away to the right. Crossing the rapid river, we pass through the large station at Brugg, where we are joined by an important main line from Berne, through Olten; then, passing the spa of Baden, we approach the outskirts of a great city. Drawing slowly into a large terminal station, we find we have arrived at Zurich, the biggest and most important town in Switzerland, with 207,000 inhabitants. We have travelled from Basel to Zurich behind a powerful electric locomotive, and have taken 76 minutes for the steeply-graded journey of 55½ miles.

At Zurich our train is reversed. Electrification of the main line from Zurich to Coire has now been completed. Last time I travelled over the route it was only partly electrified, with the result that our heavy train went out with a steam locomotive as train engine, piloted by an electric locomotive—a singular haulage combination indeed. After 17 minutes' wait we re-start at 7.43 a.m., and, making a wide circuit of the city, we find ourselves, three miles after starting, on the south-west shore of the Lake of Zurich which, with its 25 miles of length and 2½ miles' maximum width, is one of the largest in Switzerland. We skirt the lake as far as Pfäffikon, and then join at Ziegelbrucke the line that has come along the opposite bank. Making straight for the mountains we then come into sight, at Weesen, of the beginning of another large lake, called the Wallensee, pale-green in colour; and we notice that the opposite side, as we skirt the shore, consists of sheer precipices dropping straight into the water. We leave the lake at Wallenstadt, and soon afterwards we strike the Rhine Valley once again, when the train stops at Sargans. For the 56¾ miles from Zurich to Sargans the timetable allows 84 minutes, but it must be remembered that the bulk of the distance is single-line.

At Sargans we are to lose from the rear of the train the portion going over the Arlberg to Innsbruck and Vienna. This goes down the Rhine Valley for a short distance towards Lake Constance, whereas we are to turn southward up the valley. So it is with a comparatively light train that we leave again at 9.11 a.m. on our short 16-mile run to Coire. A stop is made at Ragaz, a famous spa. The next stop is at Landquart, where we have our first sight of the Rhaetian Railways, and passengers for Klosters and Davos bid us their adieux; and at 9.38 a.m. we find ourselves in the handsome new station at Coire, 15 hours 36 minutes after leaving Boulogne.

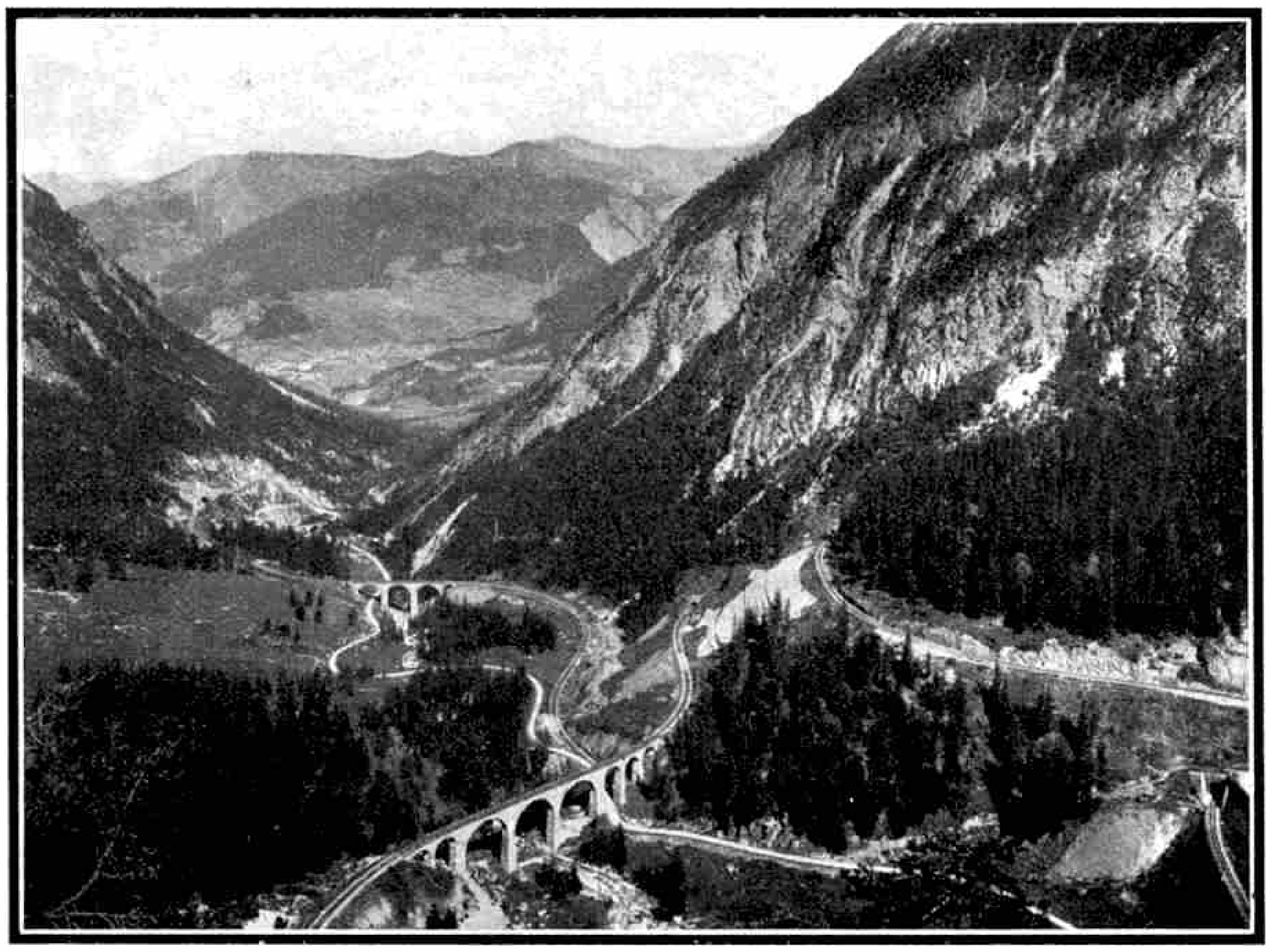
We have now to say good-bye to the luxurious blue cars that have brought us 587 miles across Europe, and to transfer ourselves and our baggage into the neat olive-green coaches of the Rhaetian Railways for the remaining 55½ miles to St. Moritz. Towards Coire we have been gradually mounting, our altitude being now 1,925 ft. above the sea; but what is this to the 5,830 ft. altitude of the station at St. Moritz, to which we have now to attain?

Eighteen minutes are allowed by the authorities for the transfer at Coire, and at 9.56 a.m. we set out, once again electrically hauled, toward the highlands of the Grisons. There is no booked stop ahead of us for just over two hours, during which we shall cover 51 miles; and in view of the gradients to be surmounted, the average scheduled speed of 25 miles an hour is remarkably high. At first we see little of note from the engineering point of view. Reichenau-Tamins marks the junction of the two main sources of the Rhine—the Vorder Rhein and the Hinter Rhein, the latter of which we cross by a steel bridge just after passing the junction station. The Disentis line, which is going up the Vorder Rhein Valley, now leaves us on the right, and we climb high up above it until we turn suddenly inward and find ourselves in the Hinter Rhein valley.

No gradient on this part of the route is steeper than 1 in 40.

The valley is broad enough until we approach the town of Thusis, where the mountains appear to close in all round us. From the depths of an amazing chasm known as the Via Mala—with sides in places 1,700 ft. in height, and yet so narrow in parts that you could almost stretch your hands from one wall to the other—there issue the waters of the Hinter Rhein. Clearly there was no way of laying a railway in this direction, apart from very extensive tunnelling.

For over seven years, in fact, the railhead of the Rhaetian Railways remained at Thusis, and the remainder of the journey to the Engadine had to be made by coach, until the engineer Hennings had devised his astonishing location of the line up the Albula Valley, and had opened the route through to Celerina in 1903. From Thusis he swung round leftward into the Schyn Ravine, deep in the bottom of which the Albula tempestuously forces its way to join the Rhine. We climb high up the left bank, with glimpses between many tunnels of the foaming torrent, far down a precipitous slope below us. Emerging into more open country at Solis, Hennings found it necessary to carry his line across to the opposite bank, and this he did by the great Solis Bridge. Founding his main piers on the rock on both sides of the gorge, he built his beautiful masonry arch, carrying the rails 292 ft. above the water. The Wiesen Bridge, which figures in one of the illustrations, is of a very similar type, save that in this case the foundations had to be carried almost down to the water-level, 289 ft. below the rails. The span of the latter remarkable arch is 180 ft.



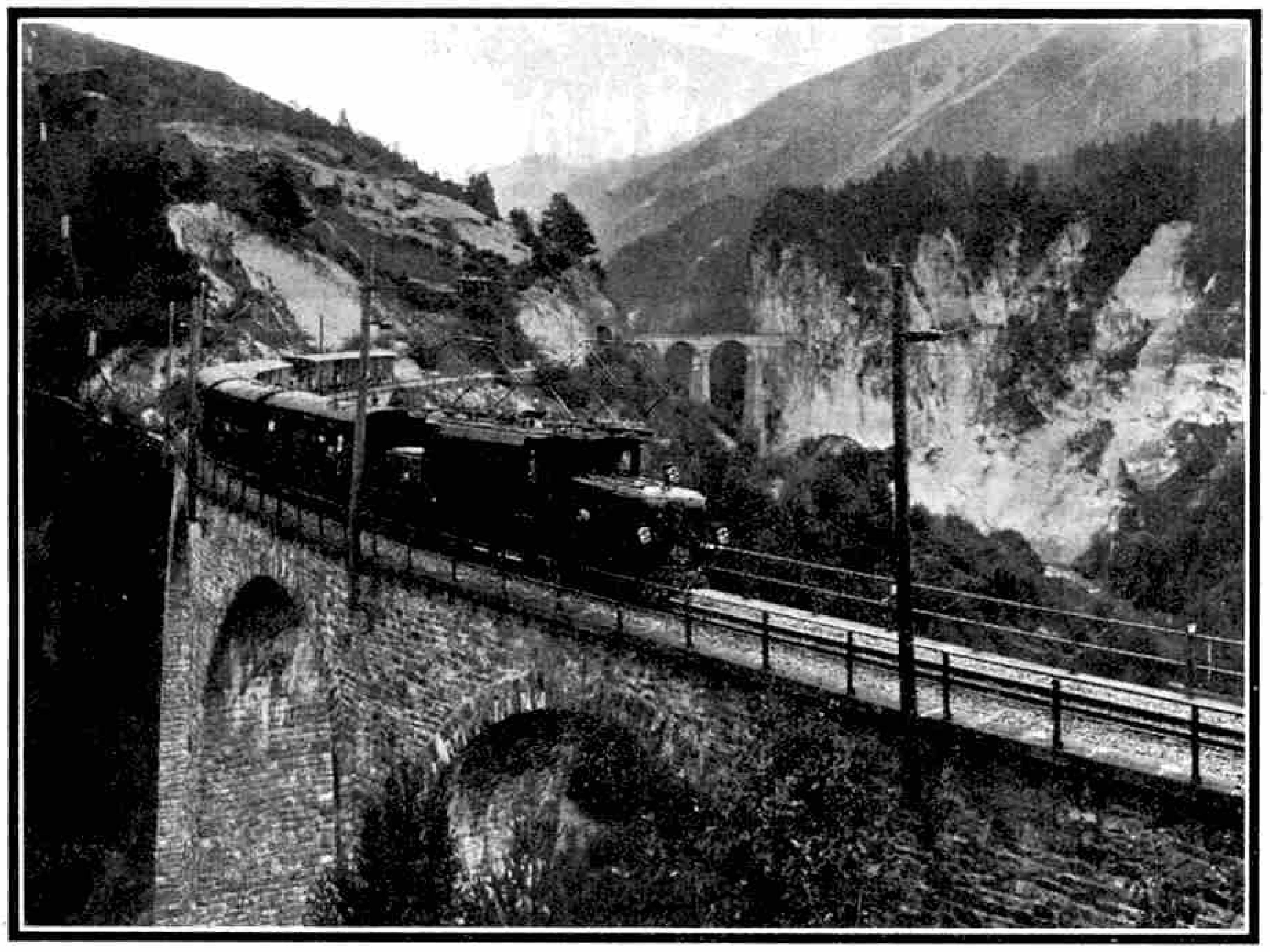
Courtesy] [*Swiss Federal Railways*

The remarkable spiral location of the Rhaetian Railways main line between Bergün and Preda

Wiesen Bridge is on the other section of the Rhaetian main line, coming up from Landquart through Davos to join us at Filisur. Before the two sections can effect a junction, however, we have also to jump across the same Landwasser River—a tributary of the Albula—which we do by means of the Landwasser Viaduct. We shall agree that this is one of the most breathless structures it has ever been our lot to cross. Curved sharply round on a radius of 328 ft., rising on a gradient of 1 in 40, and 213 ft. above the floor of the valley, the last arch of the viaduct on the opposite side is built directly into the face of a precipice, and we are ushered straight into the blackness of a tunnel the moment we have crossed—a most singular experience. We have, on reaching Filisur, travelled 31½ miles from Coire and reached a height of 3,550 ft. above the sea.

Climbing has now to begin in serious earnest. For the final ascent of the Albula Valley a gradient of 1 in 40 is of little use, and the figure steepens to "35 in 1,000," as it is reckoned abroad, or about 1 in 29. This climbing naturally has the effect of reducing our speed somewhat, but we still find our powerful locomotive travelling upward at a steady 20 miles an hour. Just beyond Filisur we enter a spiral tunnel, and on emerging, at an altitude higher by 80 ft., look down on the stretch of line over which we were running just previously. Steadily ascending, with the Albula for most of the distance far below us on the right, seen through a dense pine forest, we approach the prominently-situated village of Bergün; in 5½ miles from Filisur we have climbed 960 ft.

Now the most tortuous part of the journey lies immediately ahead. Preda is but 3½ miles away, in a bee-line, but it is another 1,335 ft. above us, and we are going to cover 8¼ miles in order to get there. First of all, by the aid of a couple of curved tunnels at the two "elbows," we describe an immense double bend on the rocky slopes above the village. Coming back into the main valley, high above the Albula, we continue climbing until the ascending bed of the rushing stream has nearly overhauled us, when we cross it and describe a completely spiral tunnel in the opposite mountainside. But a short distance afterward we recross the stream, and enter a second spiral tunnel, following which we double over the stream and double back yet again—by masonry viaducts in each case—to enter a third spiral tunnel immediately above the second! These turns and twists are so bewildering that the traveller soon loses his bearings completely. At last we reach Preda, 5,880 ft. above the sea, and the railway, as though exhausted with its efforts, seeks refuge in a tunnel.

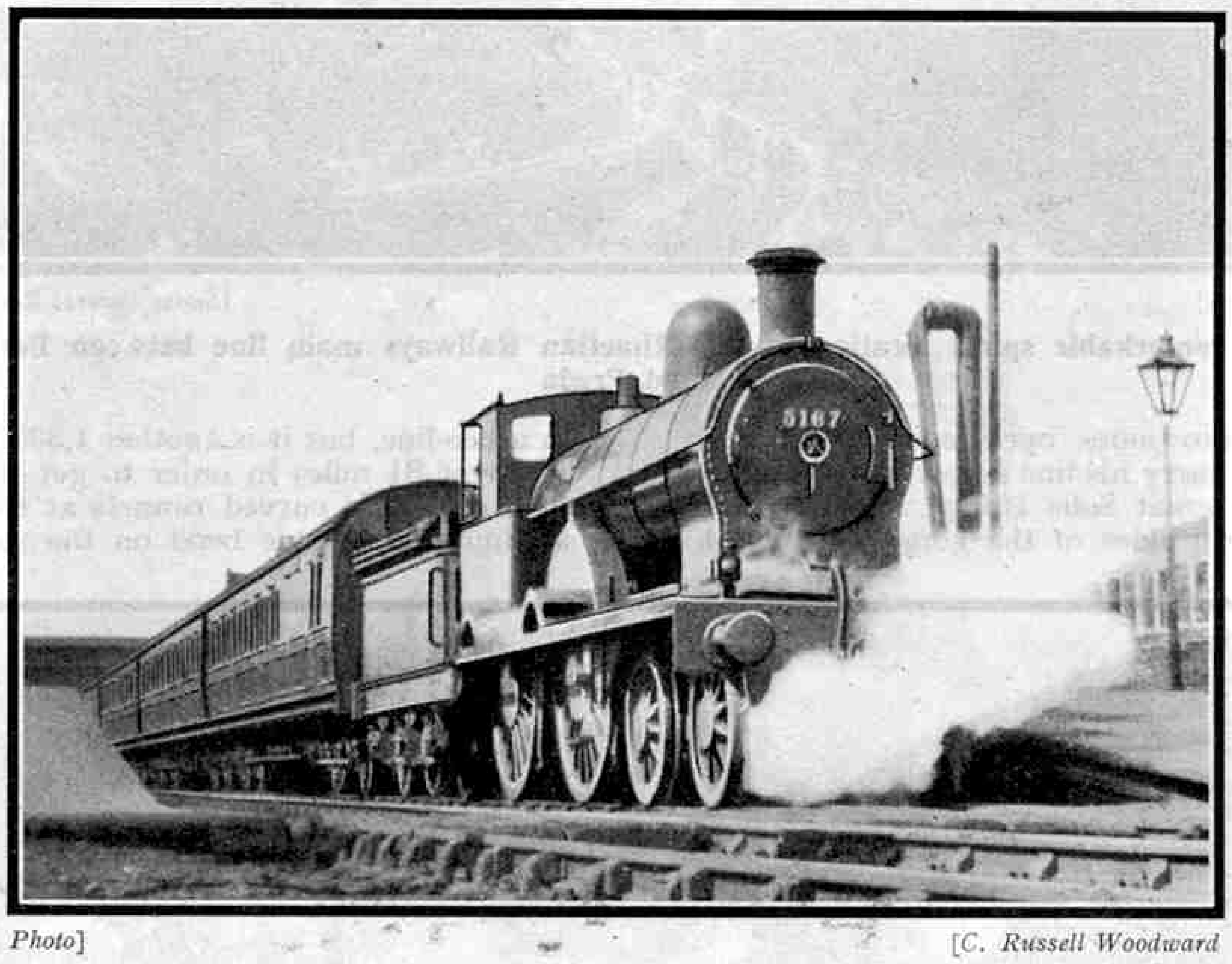


Courtesy] [*Swiss Federal Railways*

The Engadine express crossing Schmittentobel Viaduct, Rhaetian Railways. The Landwasser Viaduct is seen in the background

If you look out of the carriage window in a forward direction just before the tunnel is entered, you will see right through it, as it is perfectly straight from portal to portal. But you will be pardonably astonished as you travel through to find that it is no less than 3¾ miles

(*Continued on page 340*)



Photo] [C. Russell Woodward

Birkenhead-Chester Express leaving Hooton (L.M.S. and G.W. Joint) Station. The locomotive, No. 5167 "*Jupiter*," one of the 4-4-0 "Renown" class, has recently been withdrawn from service

G.W.R. Locomotive News

The following "Hall" class locomotives have now been completed :—4901, "*Adderley Hall*"; 4902, "*Aldenham Hall*"; 4903, "*Astley Hall*"; 4904, "*Binnegar Hall*"; and 4905, "*Barton Hall.*"

2-6-2 Tank Goods Locomotives Nos. 5560-5564 have been completed at Swindon Works and have been noted working in the Bristol district. Other 2-6-2's of this class working in the same district include Nos. 5541 and 5553-7.

Goods 0-6-0T. 5725, recently delivered by the North British Locomotive Co. Ltd., of Glasgow, is now in service.

In response to a number of requests, we are publishing a list of the names and numbers of the "City" class locomotives :—3700, "*Durban*"; 3701, "*Gibraltar*"; 3702, "*Halifax*"; 3703, "*Hobart*"; 3704, "*Lyttelton*"; 3705, "*Mauritius*"; 3706, "*Melbourne*"; 3707, "*Malta*"; 3708, "*Killarney*"; 3709, "*Quebec*"; 3710, "*City of Bath*"; 3711, "*City of Birmingham*"; 3712, "*City of Bristol*"; 3713, "*City of Chester*"; 3714, "*City of Gloucester*"; 3715, "*City of Hereford*"; 3716, "*City of London*"; 3717, "*City of Truro*"; 3718, "*City of Exeter.*"

The following "Hall" class locomotives have been seen working in the Bristol area recently :—4907, "*Broughton Hall*"; 4908, "*Broome Hall*"; 4909, "*Blakesley Hall*"; 4910, "*Blaisdon Hall*"; 4907-9 are stationed at Plymouth (Laira) Sheds.

* * * *

S.R. Locomotive News

The following is a complete list of the 16 engines of the "Lord Nelson" class :—850, "*Lord Nelson*"; 851, "*Sir Francis Drake*"; 852, "*Sir Walter Raleigh*"; 853, "*Sir Richard Grenville*"; 854, "*Howard of Effingham*"; 855, "*Robert Blake*"; 856, "*Lord St. Vincent*"; 857, "*Lord Howe*"; 858, "*Lord Duncan*"; 859, "*Lord Hood*"; 860, "*Lord Hawke*"; 861, "*Lord Anson*"; 862, "*Lord Collingwood*"; 863, "*Lord Rodney*"; 864, "*Sir Martin Frobisher*"; 865, "*Sir John Hawkins.*"

The last engine of a batch of 15 mixed traffic 4-6-0 class "S.15" locomotives has been completed at Eastleigh.

Ten Passenger engines of the 2-6-0 type, class "U," have been built at Brighton, and two engines of the same class have been completed at the Ashford Works.

The first of an order of eight 3-cylinder 0-8-0 shunting tanks is nearing completion at Brighton.

Eight more of the "Stroudley" 0-6-0 type Tank engines, class "E.1" Central section, are being altered to 0-6-2's and will work over the Torrington-Halwill Branch when ready.

New work in hand includes five 3-cylinder 2-6-0 mixed traffic engines with 5 ft. 6 in. diameter driving wheels, ten 3-cylinder 2-6-0 passenger engines with 6 ft. diameter driving wheels, and ten large 3-cylinder 4-4-0 locomotives. We understand that it is intended to run the new 4-4-0 locomotives over the Eastern section.

* * * *

L.M.S. Locomotive News

Work is shortly to be commenced on a series of large 0-8-0 superheater goods engines at Crewe.

"Claughton" class locomotive No. 5915, "*Rupert Guinness,*" has been adapted to work over the Northern division lines.

2-6-0 mixed traffic engines Nos. 13100-9 are finished and are now in service.

"Claughton" class locomotive No. 5908, "*Alfred Fletcher,*" has been re-boilered, and the name should be added to the list of nine re-boilered Caprotti "Claughtons" given last month. No. 6027, mentioned last month, is not included in the list of re-boilered Walschaerts "Claughtons."

Five new 0-6-0 shunting Tank engines, Nos. 11270-4, have recently been completed at Derby, and some additional 2-6-4 "2300" class passenger tank engines are now being constructed there.

Recent withdrawals include "Experiment" class 4-6-0 locomotive No. 5492, "*Sanspareil.*" "Precursor" class, 4-4-0's 5238, "*Ilion*"; 5264, "*Pacific*"; 5312, "*Velocipede.*" "Renown" class 4-4-0's, 5160, "*Resolution*"; 5167, "*Jupiter*"; Class "B" 0-8-0 Compounds No. 8916, 8919 and 8938, and 2-8-0 No. 9614.

* * *

L.N.E.R. Locomotive News

Twelve more "Sandringham" type engines are included in the L.N.E.R. 1929 building programme. These will replace a number of old engines of the 2-4-0 type on the Eastern section of the Southern area.

According to all reports, the J.39 class goods engines are proving an outstanding success, both on fast goods and passenger excursion work. Twenty-seven more of these engines are to be built. Three will go to Scotland, eight to the North-Eastern area and 16 to the Southern area.

Twenty-four 0-6-2 "Metropolitan" tanks will be transferred from Scotland to the King's Cross district.

Three of the nine 2-6-0 "K.3" class mixed traffic engines to be built shortly are to be used in the Scottish area, and six in the Southern area.

Two "T.1" class 4-8-0 large type banking engines have been transferred from the North-Eastern area for special work in the new Whitemoor Yard.

One of the N.E. 0-4-4-0 electric goods locomotives is to be converted to a Diesel electric unit and will be transferred from the North-Eastern area to the Southern area for trial purposes.

We understand that a contract has been placed with William Beardmore & Co. Ltd. of Dalmuir for a Beardmore Diesel Electric Set similar to that running between Lytham and Blackpool on the L.M.S.

Five new "Pacifics" have been completed at Doncaster. They are Nos. 2748, "*Colorado*"; 2749, "*Flamingo*"; 2750, "*Papyrus*"; 2751, "*Humorist*"; 2752, "*Spion Kop*."

Two more "Shire" class locomotives are reported to have left Darlington. These are Nos. 336, "*Buckinghamshire*"; and 352, "*Leicestershire*."

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The Lure of Speed: Air versus Rail

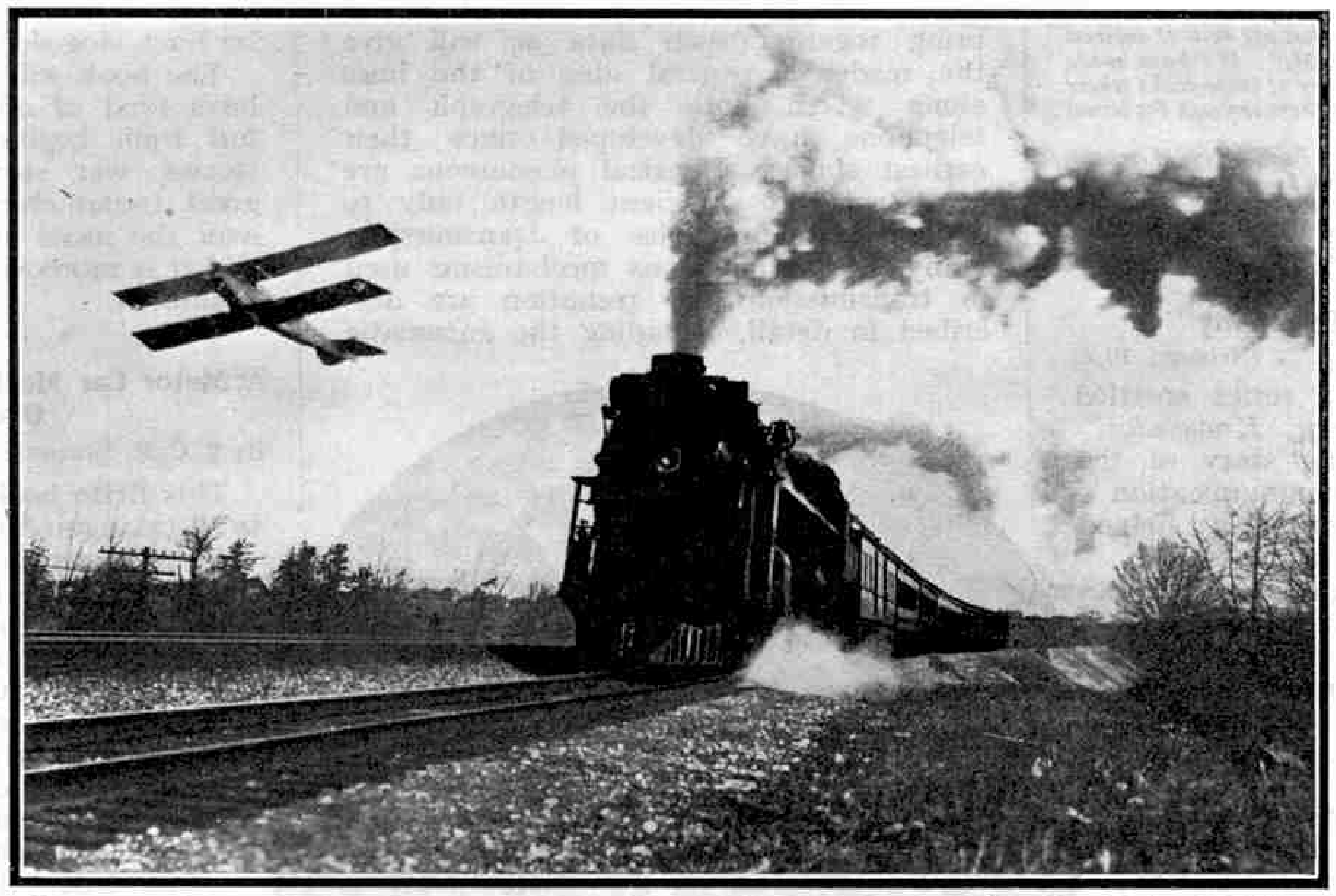

Photo courtesy] [*Canadian National Railways*

The "International Limited," the crack Canadian National Railways train, which runs daily between Montreal and Chicago, racing a passenger aeroplane at a point on the line near Toronto

"Royal Scot" Compounds at Last?

It is reported that the L.M.S. are to carry out some very interesting experiments during the coming summer with a locomotive of the "Royal Scot" type. The engine will be built by the North British Locomotive Co. Ltd. of Glasgow, and will be specially fitted with a Schmidt-Henschel system high-pressure boiler.

For some time past there has been considerable surprise in railway circles at the fact that the "Royal Scot" locomotives were built as 3-cylinder simples, in spite of the outstanding success of the "Standard Compounds" of this railway, which are said to form one of the most economical classes of engine in the country in regard to thermal efficiency. The experiments this summer will prove all the more interesting as the "Royal Scot" in question will be a "compound" engine!

The Schmidt-Henschel system is rather complicated, but the main features include a specially constructed drum, through which pass a number of steam tubes. The high-pressure steam is generated in this drum by the passage of highly superheated steam through the tubes, the necessary high degree of superheat being obtained by means of a water tube fire-box.

* * * *

"Sentinel-Cammell" Rail Cars for the C.L.C.

The Sentinel Waggon Works Ltd., have received an order from the Cheshire Lines Committee for four gear-driven "Sentinel-Cammell" steam rail cars, each with seating accommodation for 59 passengers. The cars are to be built on the same pattern as those that were delivered to the L.N.E. Railway recently, and should prove ideal for the local C.L.C. passenger work.

* * * *

Opening Out a Tunnel

An interesting piece of demolition work has been carried out on the L.M.S. Railway near Barnt Green, on the Birmingham and Gloucester line of the L.M.S.R., where the Cofton Tunnel has been opened out and is now a deep cutting.

The tunnel, which was originally 440 yards in length, was blown up in sections during temporary stoppages of train services. The last section was 140 yards in length and was blown up on a Saturday evening, all train services having been stopped at 10 o'clock. The debris was cleared away by some 200 men and 150 trucks, and the line was ready for use by the following Monday morning.

In order to complete the conversion it was necessary to cut through a wall of rock approximately 25 ft. in width and 12 ft. in depth, and now the work has been completed Cofton Cutting is one of the largest in the country.

* * * *

Diesel Locomotives for Africa

Kerr-Stuart & Co. Ltd., of Stoke-on-Trent, have recently completed two 60 h.p. Diesel locomotives. One has been delivered to the Sudan Government and the other to the Roan Antelope Copper Mines of Rhodesia.

DIFFICULTIES EXPLAINED

8.—Hinged Plates over Buffer Stops

The hinged plates that are sometimes to be seen over buffer stops at the end of sidings are used for loading road vehicles on to motor trucks or other similarly constructed wagons. The end doors of the railway wagons are opened and the plates are lowered to form gangways for the wheels of the road vehicles.

Container Tank Cars

Although the container system for milk transport has not yet been by any means finally adopted in America, the New York Central Lines have recently placed into service a container wagon, complete with a number of glass-lined milk containers, as an experiment. We understand that the car is divided into nine compartments, and each contains one of the steel glass-lined tanks.

The containers are so fitted as to make it a simple matter to unload them from the wagons on to road lorries, and patents for the idea have been taken out both in the U.S.A. and Great Britain. As in the case of those used on the L.N.E.R., G.W. and L.M.S., each tank has a manhole opening at the top for the entrance of the milk. Each of the container tanks has a capacity of 600 American gallons, which is equivalent to the capacity of 60 standard railway milk cans.

* * * *

Longest Tunnel in America

The 7.8 mile tunnel under the Cascade Mountains, which has been constructed by the Great Northern Railway of U.S.A., was completed on 12th January. It is the longest tunnel in America and has cost $15,000,000.

An important feature in connection with the building of this tunnel was the electrification of the 72.9 miles of line extending from Wenatchee, some 50 miles east of the east entrance, to Skykomish, about 14 miles west of the west entrance.

* * *

Lentz Valves

Many readers appear to be at a loss as to the functioning of the Lentz valves that have recently been fitted to the L. & N.E. "Shire" class locomotive No. 329, "Inverness-shire," and 4-6-0 No. 8580 of the revised "1500" class.

The valves used are what are known as "Poppett" valves, and are very similar to those used in most petrol engines, although they are, of course, much larger. As in the case of petrol motor valves, Lentz valves are lifted from their seating by means of cams, and are returned by strong valve springs.

Cams operating the valves of outside cylinders are timed by standard Walschaerts valve gear, and in three- and four-cylinder engines the middle valves are worked by a combination of levers from the two outside valve gears.

There are two "Poppett" valves at each end of each cylinder. One valve admits the steam to the cylinder and the other allows the steam to escape after it has performed its work.

According to the L.N.E.R., the use of valves of this description should result in great economy, one of the primary reasons being that the steam can be admitted to and exhausted from the cylinders with far greater rapidity than is possible with the ordinary slide valves or piston valves usually fitted to the standard type of locomotive.

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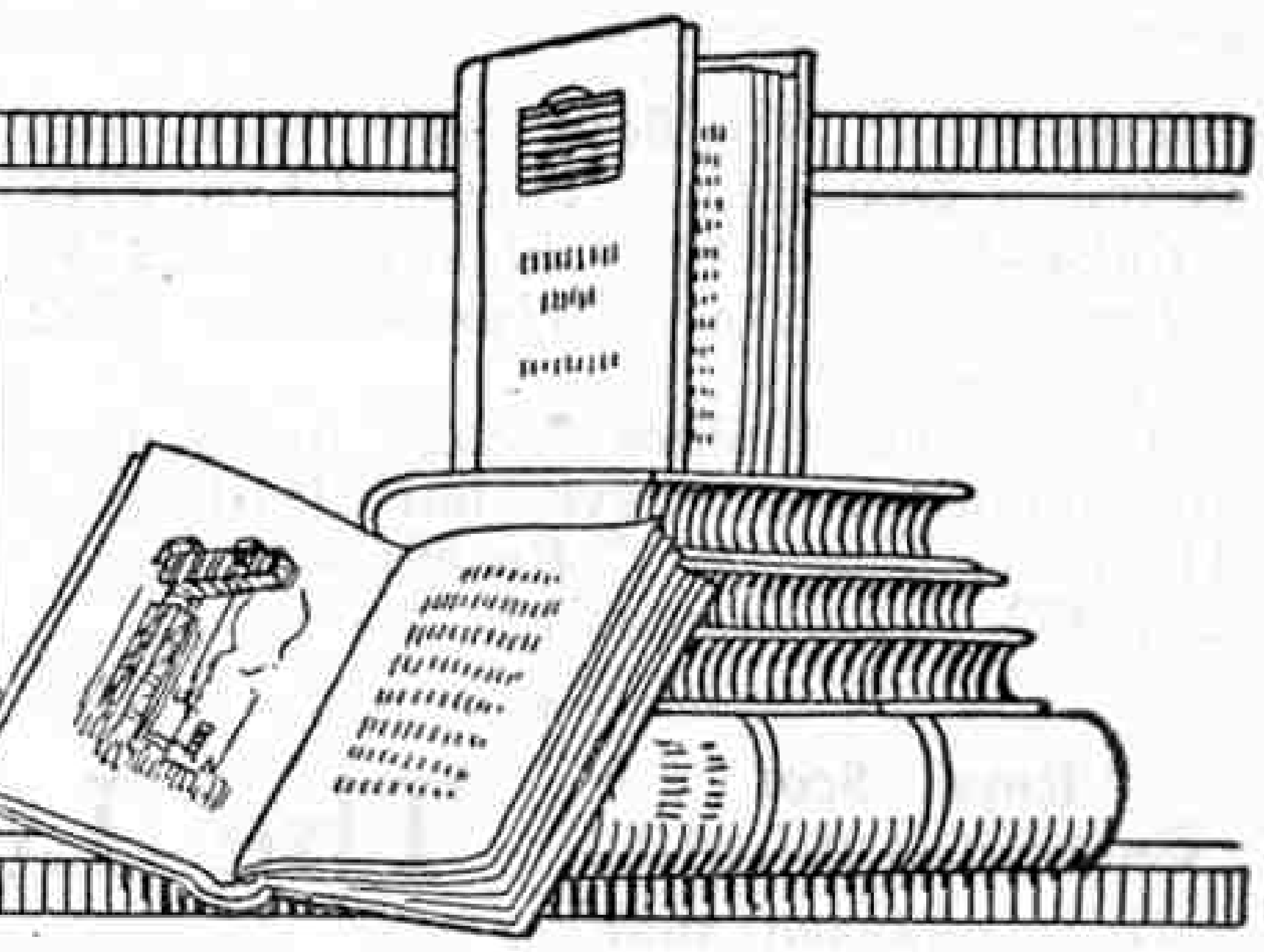
To avoid confusion with certain of the "Royal Scot" class engines, nameplates are being removed from the similarly named old L.N.W. locomotives.

Books to Read



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Telegraphy and Telephony"

By Archibald Williams (Nelsons. 10/6)

This volume, one of a series entitled "*High Roads of Modern Knowledge,*" deals with the fascinating story of the development of rapid communication – a development that enormously helped civilisation and human progress.

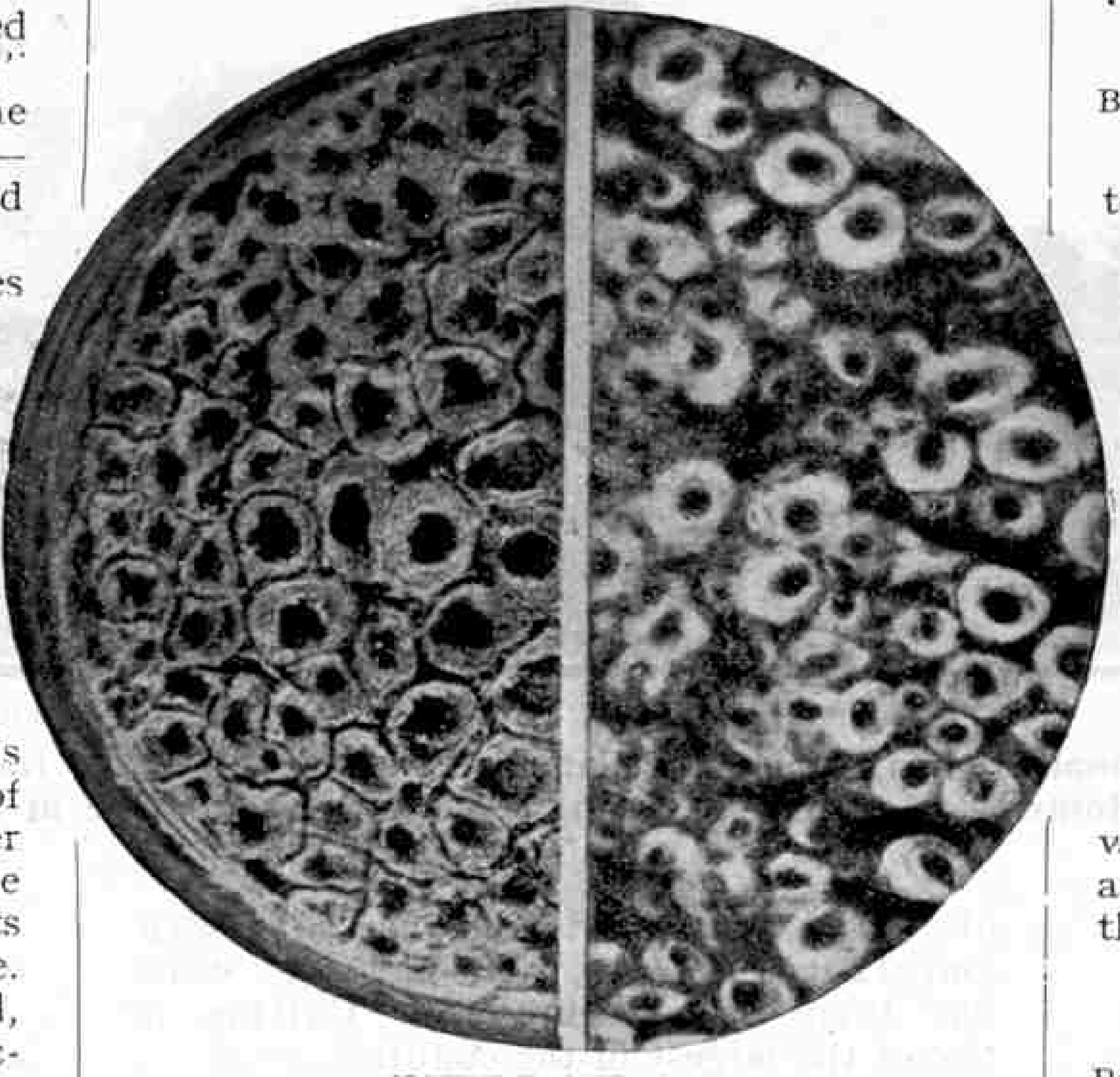
The first system of signalling messages in words dates back only to the end of the 18th century, when Napoleon established semaphore signalling over routes that are said to have totalled some thousands of miles. The semaphore was used mainly for military purposes and could do its work only during clear weather and in day-time.

After this came the revolution brought about by the electric telegraph, so different to the semaphore in that it is available at any moment, irrespective of light or dark and irrespective of weather conditions. It sends signals with the speed of light between any two points connected only by an insulated wire. Within 40 years of it being introduced, the electric telegraph was in use in practically every civilised country in the world and crossing the beds of oceans, it soon linked up distant parts of the world, in spite of the fact that it had to fight hard against prejudice!

Almost before the true value of the telegraph had been realised, a powerful rival in the form of the telephone appeared. This was something even more wonderful than the telegraph—which, after all, required the employment of a skilled operator for the actual transmission of a message. The telephone gave direct communication and did what no telegraph could do, transmitted not merely ideas but personality as well.

The next step was the elimination of the metallic conductor, which was made possible by the discoveries of Hertz and other pioneers. To-day, not only can the pilot of an aeroplane speak to spectators on the ground but it is even possible to telephone from the shore to a ship at sea. As at present developed the wireless telephone finds its greatest usefulness in transmissions over great distances or under conditions where wired communication is impossible. As yet one cannot imagine wireless telephony taking the place of the dense network of wires established in thickly populated countries, but the two methods—wired and wireless—give us universal ease of communication under all conditions.

The object of the present book is to bring together such data as will give the reader a general idea of the lines along which both the telegraph and telephone have developed since their earliest stages. Physical phenomena are dealt with at sufficient length only to explain the principles of transmission. Many of the ingenious mechanisms used in transmission and reception are described in detail, including the automatic apparatus that is finding its way into many large telephone exchanges to-day. The work of such pioneers as Wheatstone, Morse, Bell, Hertz and Marconi makes fascinating reading and the whole book is full of interesting and useful information. It is well printed and includes numerous illustrations and figures in the text, which help to make clear the technical details.



NATURE AND ART
One half of this illustration shows a half section of an air-space telephone cable. The other half is a much magnified half section of the spinal cord from a human being. In both cases each conductor, whether it be wire or nerve, is insulated from its fellows. So similar are these works of Nature and Art that it is impossible for the uninitiated to distinguish one from the other. (From "Telegraphy and Telephony" reviewed on this page

* * * *

"When Fur was King"

By Moberley and Cameron
(J. M. Dent & Sons, London. 10/6)

This fine story of pioneer work in Canada is a first-hand and vivid account of adventurous life in times that have now disappeared. It is written by a survivor and deals with the North West during the last half of the 19th century, when there were no towns or buildings except a few isolated out-posts and when huge herds of buffalo roamed the prairies. At this time the Red Indians were free and wild, and carried on their incessant warfare. The Hudson Bay Company's rule was the only law, and travel was done either by boat, dog-sledges, or on horse-back.

The book will appeal specially to those boys fond of adventure stories for it is full from beginning to end of hunting stories, war stories, and stories of the great Indian chiefs. It has an advantage over the usual story-book by being true, and it is moreover an important historical document.

* * * *

"Motor Car Mechanism, Management and Overhauling"

By E. C. M. Shepherd (Crosby Lockwood & Son. 2/6)

This little book is particularly directed to all taking up motor driving. It explains the construction and operation of motor cars, how to keep and drive a car, and how to carry out wayside repairs and similar information.

As the author points out in his preface, it is a comparatively simple matter to drive a motor car but no-one should be content to have charge of one without a thorough knowledge of its mechanism. Without this knowledge it is quite impossible to keep a car in running order and to make the small adjustments necessary from time to time. The book is well illustrated both in line and halftone, and the figures throughout help to make the text clear.

* * * *

"The Golden Age"

By Kenneth Grahame (The Bodley Head. 7/6)

Probably no writer has penetrated more cleverly and more completely the secrets of childhood than Mr. Kenneth Grahame. In this book he tells us of the happy days—rightly called "The Golden Age"—of a family of several children who seem to have all kinds of interesting adventures. Although these are of a kind that probably occur to most healthy children who enjoy life, we are entertained by the very realistic manner in which Mr. Grahame succeeds in getting them into print.

There is young Harold, for instance, who has the strange craze of always wanting to play being a muffin-man. He wanders through passages and up and down staircases ringing a noiseless bell and offering phantom muffins to invisible customers! Another likeable youngster is Edward, who is sent to a boarding school and is seen off at the station by the family. He is proud of his entry into school-life, and carefully disposes of his boxes on the platform so that everyone may see the labels and read his name and destination on them! How like a boy, when he leaves home alone for the first time.

Whilst this book may not appeal very strongly to our readers themselves, we feel quite sure that any of their fathers and mothers who read it will find a fund of humour and much that is entertaining in its pages.

"The Pageant of Civilisation"

By F. B. Warren (Benn. 21/-)

Probably only a comparatively few collectors know anything of the world of romance and adventure that is represented by the contents of their albums. Even those who do take an interest in the historical side of stamp collecting would never think that anyone would have the ingenuity or daring to write a book that would adequately describe this side of the subject. However, here is the very book for which we have been hoping—and most admirably does it fill this vacant space in the literature of philately.

Since 1840, there have been issued some 150,000 different varieties of postage stamps, and from these it has not been a difficult task for Mr. Warren to select his material. The book is filled with picturesque stories of romance and adventure, not only in the well-known but also in the obscure lands of the earth. We are told of the only Catholic who was ever a resident of the White House at Washington; about a priest who left a mass to start a revolution; of an invitation to a Panama Conference that was the cause of a duel in Washington. We are intrigued by the story of how an Irish merchant headed the Argentine Navy; and how a Chicago lawyer became Premier of a Soviet state. Amazed to learn how a printers' error created Napoleon III; and how a coachman's son, a stonemason, and an ostler each came to rule a nation. Then there is the story of the Austrian artist who painted King Edward's portrait in a studio over a stable; and of the cabin boy who founded an Empire.

With these—and with hundreds of other stories of courage, treachery, ambition, victory and defeat—Mr. Warren has woven his fascinating story. His material concerns the civilised and uncivilised nations from the Cape of Good Hope to Guatemala, from Tahiti to Canada. Myth and historical fact, kings and slaves, religious faith and scientific discovery—all the imaginings and accomplishments of mankind are in some measure depicted in the myriads of stamps of the world.

The narrative results in a picture of mankind from the earliest times to the present-day, and it presents what the title of the book claims it to be—a veritable pageant of civilisation. This appeals not only to the stamp collector, but equally to the general reader, for it is a history of the world quite unlike any that has ever been written before.

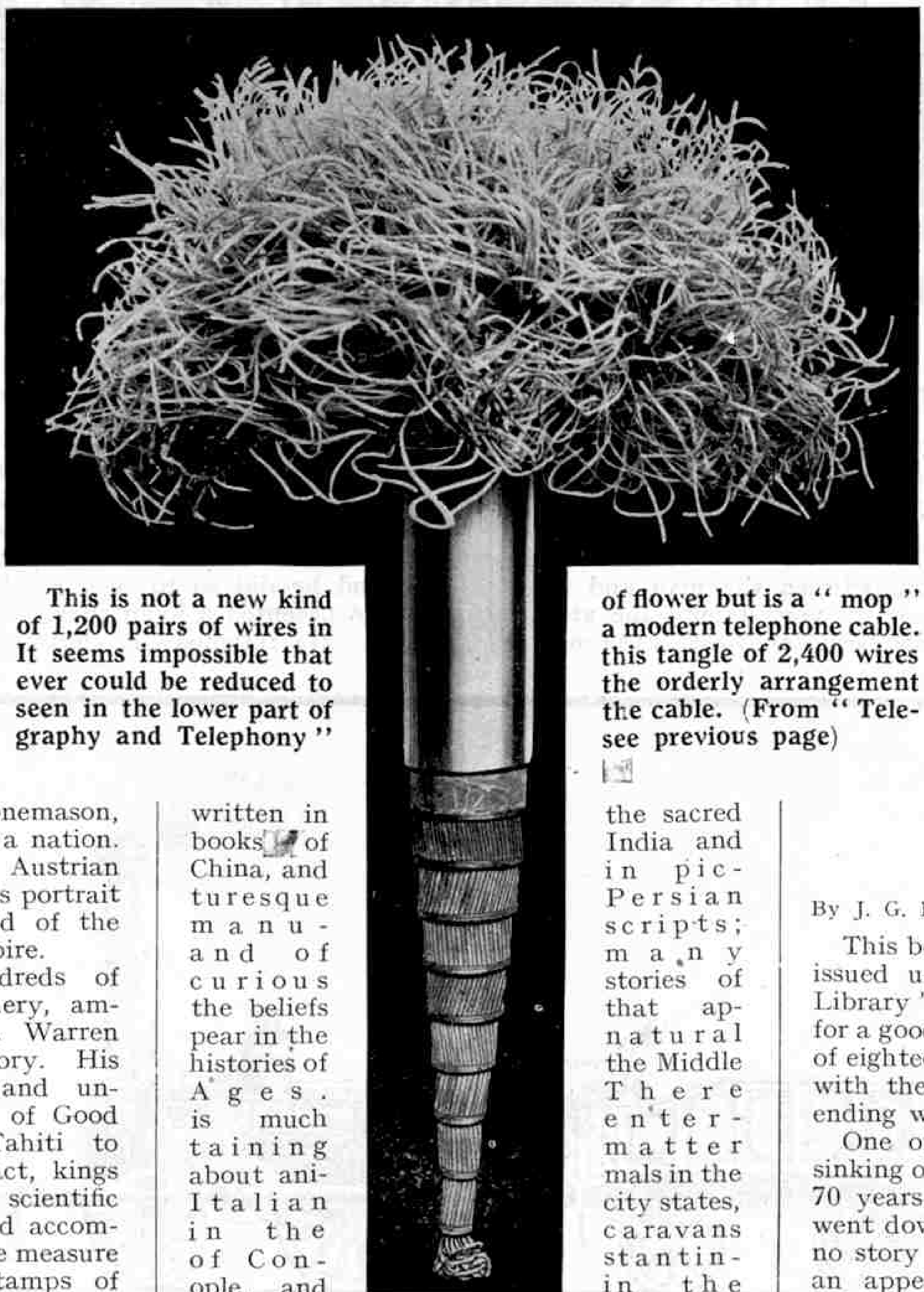
It only remains to add that there are numerous illustrations and that the book is beautifully printed. It is a gift that will please any intelligent boy—young or old—and especially so if he be a stamp collector.

* * * *

"Noah's Cargo"

By G. Jennison, M.A., F.Z.D.
(A. & C. Black. 10/6)

The sub-title of this volume, "Some Curious Chapters of Natural History," explains the scope of the book. When we learn that the author was a former head of the well-known Zoological Gardens at Belle Vue, Manchester, we are assured of some interesting reading. In this we are not disappointed, for the book contains much information—often curious and amusing—about beasts and birds, drawn from the author's long experience. It also gives some account of man's relations with them from the earliest times and we learn with surprise that the ancient Egyptians had Zoos, as also had the Babylonians and Assyrians. We are told, too, of strange tales of beasts that are written in the sacred books of India and China, and in picturesque Persian manuscripts; and of many curious stories of the beliefs that appear in the natural histories of the Middle Ages. There is much entertaining matter about animals in the Italian city states, in the caravans of Constantinople, and in the celebrated European menageries of more modern times.



This is not a new kind of flower but is a "mop" of 1,200 pairs of wires in a modern telephone cable. It seems impossible that this tangle of 2,400 wires ever could be reduced to the orderly arrangement seen in the lower part of the cable. (From "Telegraphy and Telephony" see previous page)

As is well known, the apes and monkeys are the most intelligent of all animals, and the ring-tailed Capuchin is quite equal to the chimpanzee in thinking out ways and means of reaching distant nuts with sticks of various lengths. Mr. Jennison records that at Belle Vue occurred the only instance in England of a chimpanzee making a nest. The nest was made from small branches and twigs and was thrown down and a new one made about twice a week.

It is interesting to learn that the bears apparently are a good second to the monkeys in intelligence. They are more intelligent than members of the cat family and, strange to say, the polar bears are the least clever of the group. Few animals are as clever as bears, which learn many tricks untaught and are easy to train. They appreciate soft sweet music, dislike discords and are quick at the picking up of the rhythm of a dance.

In the chapter on elephants we are told of their wonderful obedience to their keeper's command to "stand" or "move," and learn that they will suffer the severest punishment rather than disobey the last order. There are many stories throughout the ages of this implicit obedience that no will can bend and no force can break. There was, for instance, the standard-bearing elephant that was halted when his Mahout fell. There the elephant stood, heedless of the fight that waged around. When the battle drove past, the noble beast remained, firm as a rock, until the standard it carried formed a rallying point and turned defeat into victory.

An elephant presented by the King of Portugal to the Pope refused for ten days to go on board ship. "It is sad at going so far from home," said the keeper. But the elephant embarked quickly enough when someone whispered to the king the facts of the case—the keeper was unwilling to leave his little daughter!

The book has many interesting illustrations which have been gathered from original sources—mostly from old paintings, prints and manuscripts—depicting hunting scenes and legendary beasts. There are also modern photographs of animals, and these are often set side by side with old figures for comparison.

* * * *

"The Peril of the Sea"

By J. G. Lockhart (Philip Allan & Co. Ltd. 3/6)

This book—one of a series that are being issued under the title of the "Nautilus Library"—will delight any boy who cares for a good story of the sea. It is a collection of eighteen stories of shipwrecks, beginning with the loss of the "*White Ship*" and ending with the sinking of the "*Titanic.*"

One of the best stories deals with the sinking of the "*Birkenhead*," and, although 70 years have passed since this fine ship went down off the coast of Africa, there is no story of the sea that makes so stirring an appeal. Once and for all, on that January night in 1852, it was laid down that in danger at sea the weak must not be allowed to go to the wall, and in this connection the story of the "*Birkenhead*" has become a tradition of which succeeding generations are justly proud.

The "*Birkenhead*" was transporting British soldiers to fight the Kaffirs in South Africa when she struck a sunken rock. Only three of the ship's boats could be lowered, and into these women and children were placed. The troops might have rushed these boats—might have fought for places. They did not do this, however, but stood silently on deck drawn up in their ranks, well knowing how little was their chance of escaping from death. Twenty-five minutes after the alarm had been given the ship broke in half, and the sea was full of drowning and struggling men. Out of the total of 638 persons only 68 men managed to reach the shore, but the remainder left behind them a tradition of bravery in the face of danger that will live through history.

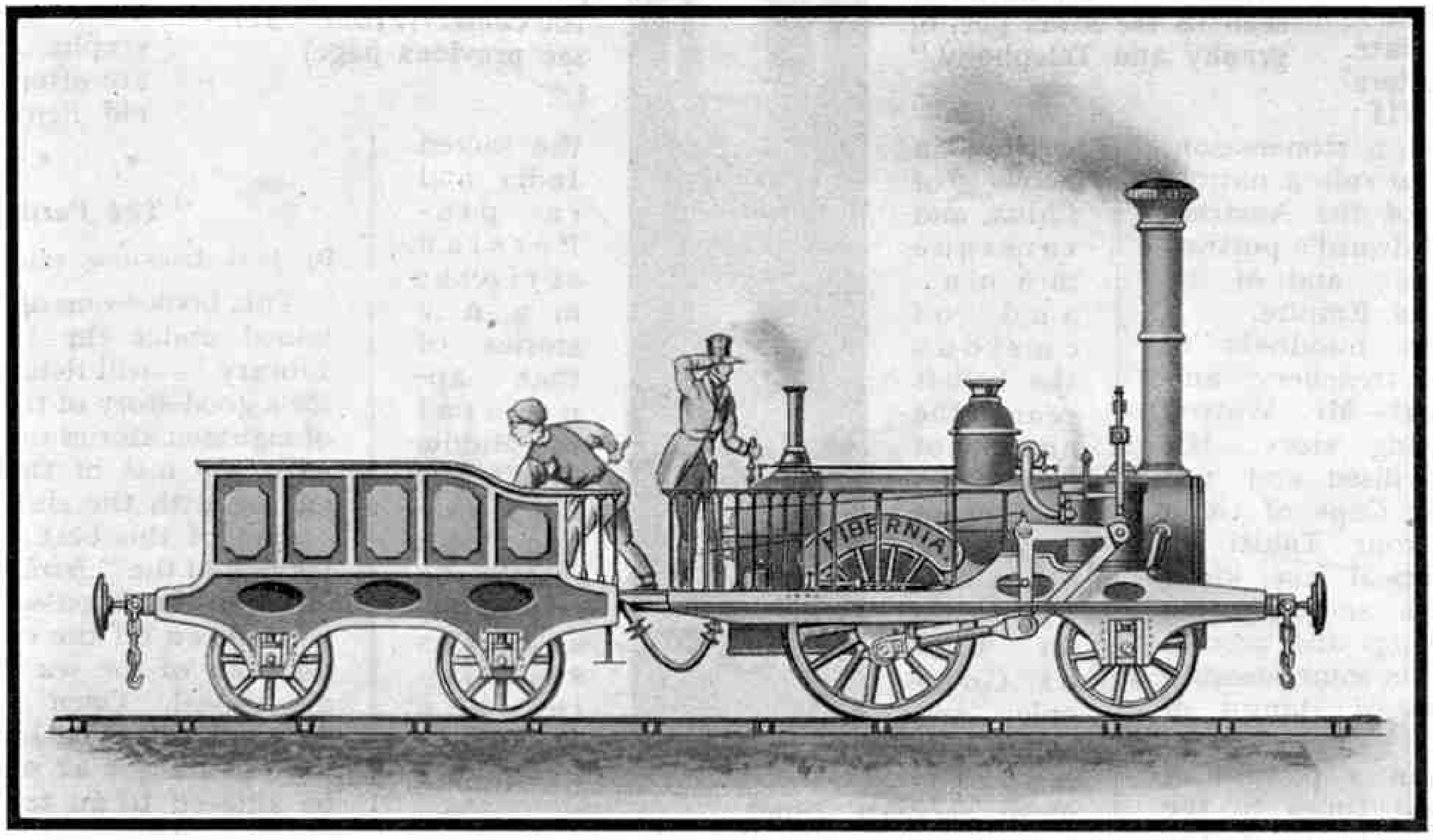
LIVES OF FAMOUS INVENTORS

XIII.—RICHARD ROBERTS AND THE SELF-ACTING MULE

By W. F. Harrison

In the last issue of the *"M.M."* the story of Richard Roberts, who could "invent to order," reached the point where, in partnership with the wealthy Thomas Sharp, he was enabled to exploit his inventive genius and carry out important engineering projects. The partners' most notable work was in the production of improved textile machinery, and began with Roberts' invention of the self-acting mule.

In order to realise the connection between the man and the invention it will be necessary to survey very briefly the steps that led to the production of what has been described as the most ingenious and valuable machine in the cotton trade.



Sketch of the "Hibernia," the first of a class of 2-2-0 locomotives built by Sharp, Roberts & Co., for the Dublin and Kingstown Railway, Ireland. This engine was referred to in last month's *"M.M."*

The spinning mule invented by Crompton, as described in the *"M.M."* of May, 1927, was one of the most important contributions to the textile industry since the invention of the fly-shuttle by John Kay of Bury in 1733. Kay's shuttle completely upset the equilibrium of the trade, and the balance was not recovered until Crompton's spinning mule became common property. For centuries before the time of Kay men were content to throw the shuttle across the loom from one hand to the other, but by means of Kay's invention a weaver could operate the loom by a lever held in one hand, thus leaving the other free. It was, in effect, a dummy hand that doubled the production on narrow looms and dispensed with an assistant on those that were more than 36 in. in width.

The voracious appetite of looms fitted with this simple but epoch-making device demanded more and more yarn, and until the water frame and the spinning jenny were invented it required in some districts at least 20 spinners to provide enough yarn for one weaver. Lewis Paul, Wyatt, Hargreaves, Highs and Arkwright by their inventions helped to overcome the deficiency, but the supply of yarn never equalled the demand until the advent of the spinning mule.

The situation then changed altogether, for the rapid development of the spinning mule led to over-production, and before long placed the loom in arrears. The next step clearly was to improve the loom, and the first power loom was patented by a clergyman, Edmund Cartwright, who was born at Marnham, Nottinghamshire, in 1743. Cartwright became the rector of a country parish, which left him with a good deal of spare time for his favourite hobby of contriving mechanical toys. In 1784 he learned, in the course of a conversation, that there was great need of a weaving machine that could keep pace with the output of Arkwright's spinning machine, and thus equalise production.

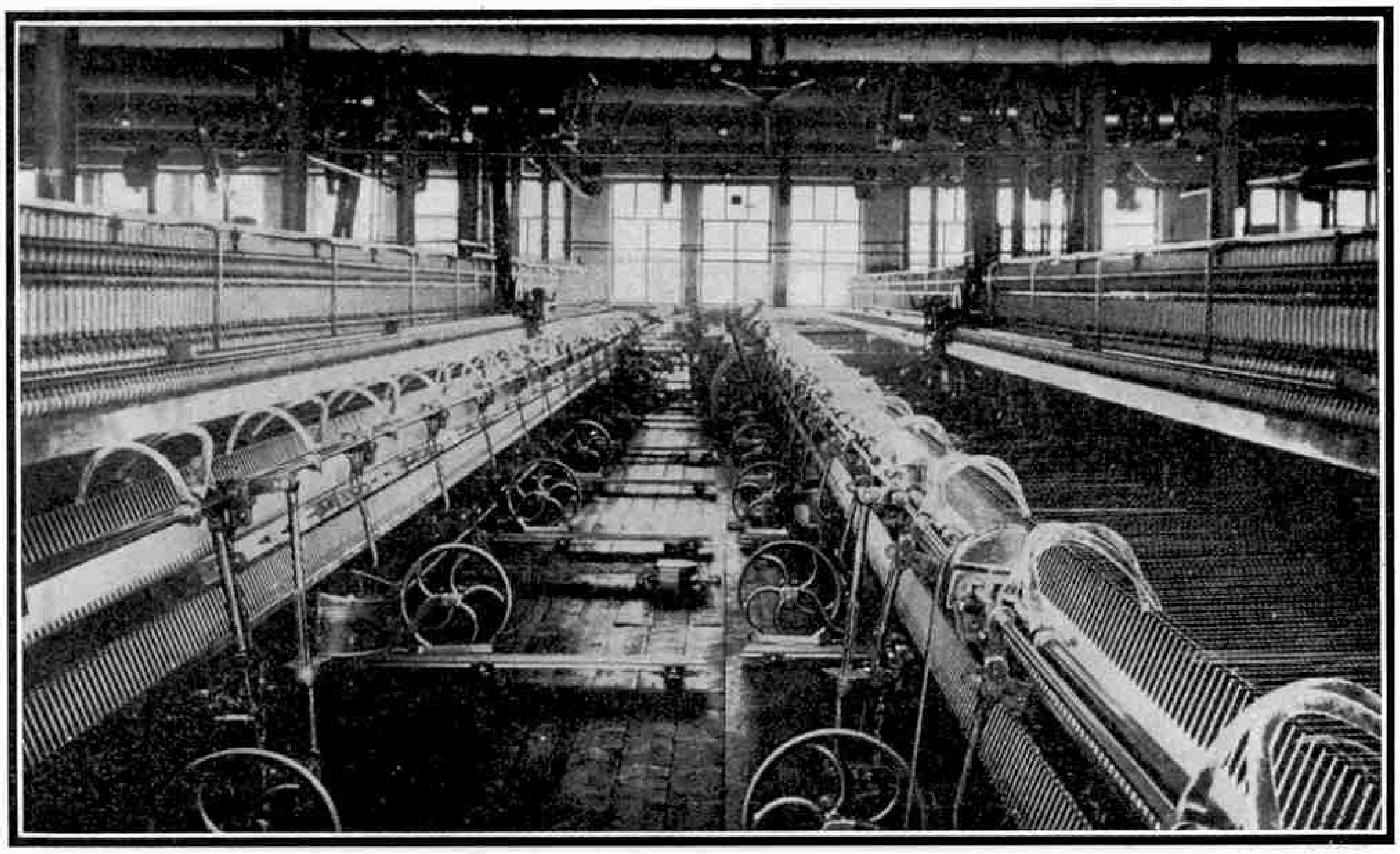
Cartwright saw a chance to put his inventive skill to practical use, and he did so to such good purpose that in the following year he patented a loom that could be driven by water or other power. He resigned his clerical post and moved to Doncaster where he established a spinning and weaving mill, the machinery of which was driven by a steam engine. The success of the loom led a Manchester firm to order 400, and these were duly supplied. They had a very short life, however, for the mill in which they were installed was burnt down shortly afterward by fanatical opponents of textile machinery.

Cartwright's patent was exploited by many mill owners as soon as its great value became realised. The inventor made vigorous protests to Parliament, however, and eventually he was awarded £10,000 in recognition of his great service to industry.

It is no disparagement to the early spinning mule to say that it was a very crude affair, for Crompton was no mechanic. He had, knowingly or unknowingly, combined the ideas of his predecessors in a machine whose complete cycle of motions defied the application of power for 45 years, yet it offered wonderful scope for improvement in almost every direction. Those who improved it in detail came from all sorts of trades. "Joiners, shoe-makers and hat-makers, attracted by the high wages paid to mule spinners, left their respective employments and became proprietors of a single mule." Thus wrote John Kennedy of Manchester, adding that "each worker endeavoured to fill up a deficiency with some expedient suggested by his former task; the smith suggested a piece of iron, the shoe-maker a welt of leather, etc., all of which had a good effect in improving the machine."

Crompton's wooden rollers with their dents of flattened brass wire were soon replaced by wrought iron ones driven by clockwork, an improvement that was devised by Henry Stones of Horwich. James Hargreaves of Toddington followed with a contrivance for drawing out the carriage by means of a parallel scroll terminating in a short incline. Kelly of Glasgow applied the power of water to the positive motions of drafting, twisting and drawing out, while almost immediately afterward Wright, of Manchester, balanced the machine to a wonderful degree by placing the headstock in the centre. Kennedy, Crompton's staunch friend, carried the mule another important step forward by inventing a method of driving the rollers and spindles by three pulleys, two fast and one loose. This development in its turn led to numerous attempts on the part of ingenious machinists to make the mule self-acting, but none proved successful.

The problems involved in devising a self-acting mule were fascinating to any keen mechanical brain, but it was not their complexity that first attracted the attention of Roberts. He became acquainted with them through the prevalence of strikes among the operative spinners. A change-over from the domestic to the factory system had been brought about gradually since the days of Arkwright, with the not unnatural result that men who previously had been their own masters found it very difficult to settle down as employees. The unrest developed into strikes, many of which had serious consequences because the spinners frequently ceased work deliberately at times when there was a great demand for cotton goods, and thus threw all the other operatives out of work and brought everything to a standstill.



Courtesy] [*Dobson & Barlow Ltd.*

A pair of Self-Acting Mules installed in an up-to-date Spinning Mill. This illustration gives an excellent idea of the great length of these remarkable machines

In 1824 there occurred a most disastrous strike among the operative spinners of Hyde, Stalybridge and Ashton. The master spinners were driven almost to desperation by the extent of their losses, and the very natural fear that trade would be diverted to other countries and finally lost. One obvious method of at any rate minimizing the effect of these strikes would be to improve the spinning mules so that they would run by means of self-acting machinery, and thus render the employers to some extent independent of their troublesome spinners.

This idea was very attractive, but the problem remained of finding a man capable of devising the necessary mechanism. Skilled mechanics in the surrounding districts were consulted, but without exception they declared the idea to be impossible, and they refused to waste time upon it. After many discouraging interviews, three of the leading master spinners visited Roberts and put their problem before him.

At that time Roberts was deeply engrossed in locomotive work, and he was not inclined to divert his attention to other mechanisms. He told the manufacturers that he knew nothing about spinning, and could not possibly consider their request. The strike continued, however, and the employers persisted in the matter and persuaded Roberts' partner Sharp to use his influence. In the end Roberts was prevailed upon to undertake the task, although it is probable that the complexity and difficulty of the problem had far more influence with him than the persuasion of the manufacturers and his partner.

In order to grapple with difficulties in the most practical manner he had a Crompton mule erected in the workshop, and after studying its movements and defects he produced in less than four months the first spinning mule that could, with any show of reason, be called self-acting. In this invention the controlling power was exercised by a cam shaft, by means of which all the movements of the machine were made to succeed each other regularly in their proper order, the finishing of one movement bringing about the commencement of the next. A few years later Roberts introduced further improvements, chief among which was his "quadrant" winding apparatus; and thus brought the mule to an exceedingly high pitch of mechanical perfection.

Many minor improvements in detail have been made to the self-acting mule since that time, but in general principle a modern mule such as that shown in the accompanying illustration is practically identical with Roberts's machine.

The details of a modern mule are somewhat complicated, but the principle of its operation is as follows. The mule is in two portions, with the headstock, or driving mechanism, in the centre. Bobbins of spun thread, called "roving," are mounted vertically in a frame, or "creel," at the rear of the mule. The roving from each bobbin is passed through a guide plate and between small rotating rollers, by which it is drawn. From the rollers it passes in a horizontal direction to an inclined spindle at the front of the mule and in direct line with the bobbin from which the roving unwinds.

The spindles in the long front row are driven at a high speed by means of endless belts extending from a long roller on the underside of the mule (and screened from view by the maze of moving threads above it) to pulleys at the base of the spindles. The roller and the spindles are incorporated in a carriage that moves forward and backward across the machine with mechanical regularity.

When the delivery of roving from the bobbins commences, the carriage is close to the rollers from which the yarn issues. As the roving is drawn, the carriage moves forward, the spindles mounted upon it rotating rapidly. By this combination of movements the roving receives the requisite twisting, and also is kept in tension. As soon as the carriage reaches the limit of its forward travel it pauses automatically for a brief period. The spindles continue to revolve, however, and the additional twist thus given to the stretch of yarn is termed "twisting at the head."

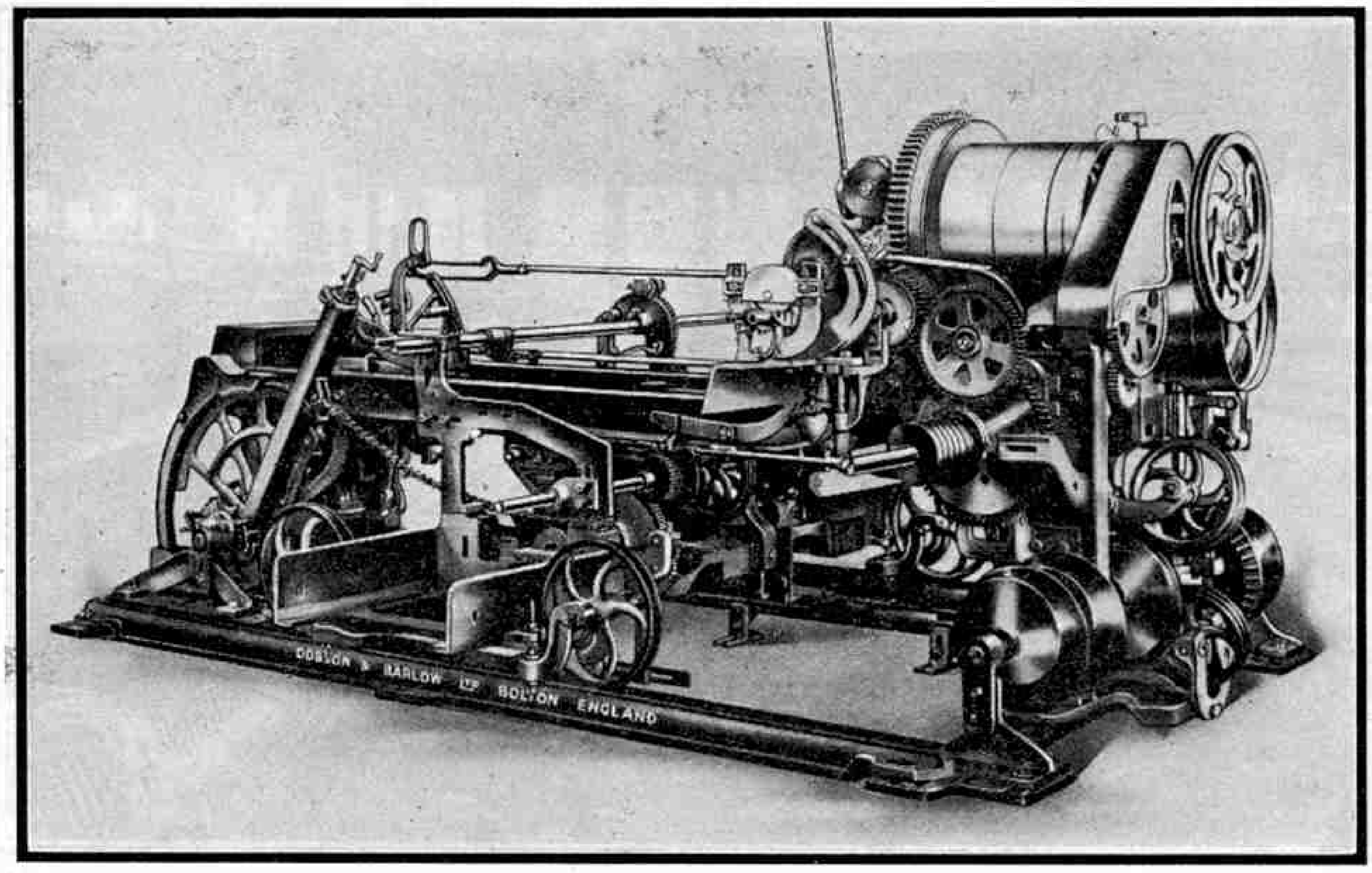
Immediately the extra twisting is completed the rotation of the spindles is stopped, and the spindles are reversed sufficiently to cause the few coils of yarn on each of them to unwind. This loosened yarn is guided automatically on to the spools, or "cops," that are mounted on the spindles. When "backing off," as the brief reversal of the spindles is termed, is completed, the carriage commences to recede, and the spindles resume their normal direction of rotation. The yarn is guided mechanically on to the cops as it becomes slackened by the backward travel of the carriage. When the carriage reaches the limit of its inward travel the spindles cease to rotate, and the intricate mechanism of the machine sets itself for a repetition of the motions described. The cops of spun yarn are removed from the spindles as they are completed.

Side by side with the making of self-acting mules and the building of locomotives, Roberts constructed power looms of such an improved type that they became, during the first half of the 19th century, the standard to which other manufacturers of textile machinery worked. It is curious to note that in books of such widely different types as Knight's ponderous "*Old England*," and a recent Oxford University Press publication entitled "*The Romance of the Cotton Industry in England*," the only mention of Roberts that is made occurs in connection with his invention and improvement of power looms.

These looms, with his improvements in the manufacture of plushes, velvets and carpets, woven on wires, and his patented apparatus for cutting the resulting fabrics, do not by any means comprise the whole of Roberts's contributions to the textile industry, but they help us to appreciate the verdict passed on this versatile inventor by Sir W. H. Bailey, when he said that it is "impossible to look at a locomotive or go into any cotton mill or machine works in the world without finding records and evidences of the prodigious and beneficial influence and power of Richard Roberts." Such weighty words spoken by an eminent engineer would be sufficient to establish the fame of any inventor.

It would require many pages of the "*M.M.*" to describe all Roberts's minor patents connected with machinery for preparing and doubling textile fibres and for imparting a glossy finish to woven fabrics, and we must pass over these in order to arrive at another important phase of the inventor's career.

In 1847-8 Roberts was called upon to extricate the contractors of the Conway Tubular Bridge from difficulty. Their trouble bore some resemblance to that of the master spinners in 1824, for it was partly technical and partly economic. The punching of the plates and girders used in the construction of the bridge was performed entirely by hand. The inaccuracy of the work, which necessitated the rimering of the rivet holes until they were shapeless, coupled with the often menacing attitude of the workers, appalled the contractors, who despaired of being able to finish the bridge within the specified time. It has been said that Roberts resolved the problem in an evening's leisure. Be this as it may, he forthwith invented the Jacquard punching machine that punched the holes with such accuracy that the heavy plates could be stacked and rods of metal threaded through! The invention enabled the contractors to make up for lost time and to complete the bridge satisfactorily.



Courtesy] **The headstock of a modern Self-Acting Mule.** [*Dobson & Barlow Ltd.*
This is situated in the centre of the Mule and constitutes the driving mechanism

From among the vast range of Roberts's activities the making of turret clocks deserves particular mention. He designed his first clock in 1825, and this in due course was erected over the company's new works in Great Bridgewater Street. Many other turret clocks erected in the district were made under his supervision, but perhaps the most interesting and most beautiful specimen of his handiwork is to be found in the church turret of his native parish of Llanymynech. This clock is said to have been erected principally for the benefit of the workers in the local limestone quarries where Roberts was employed in his youth.

In 1851 he turned his attention to screw propellers, and he claims in his specification to have improved them by "making the boss much larger than usual in order that the vanes may act more effectively on the water, and in extending the bosses backward far enough to admit of their being tapered or otherwise formed so as to allow the water to close upon them without a counter current being produced."

In 1852 Roberts retired from the practical side of machine making to become a consulting engineer, and from that time his activities became so numerous and varied as to be almost bewildering. From his improved and patented machine for regulating and measuring the flow of fluid pumps he turned to the perfecting of turbines, anchors, lifeboats, hydraulic presses and omnibuses! He also invented a companion to his Jacquard punching machine in the shape of one for shearing and punching both webs of angle or T iron simultaneously.

One of the most interesting phases of Roberts's later years was in connection with his improvements to steamships, armaments and ordnance. The man who had been so unwarlike in his youth, and so unwilling to fight against the first Bonaparte, was received by Napoleon III, who consulted him about armour-clad and turret ships. It is said that Roberts was at that time so far advanced in warlike designs that he had in his pocket a plan for blowing up Sebastopol! Whatever credence may be given to this statement, it is nevertheless true that the inventor was also consulted by the Emperor of Russia and invited to take up his residence in St. Petersburg (now Leningrad).

Although Roberts could not be persuaded to live out of England, he left the north and spent the last few years of his life in London, where he devoted himself chiefly to the principles of marine construction. In addition to designing large ocean-going liners he devised no less than 33 improvements in connection with twin-screw steamers and propellers. Some of these improvements he incorporated in the "*Flora*," a small vessel that ultimately became a blockade-runner in the American War of Secession.

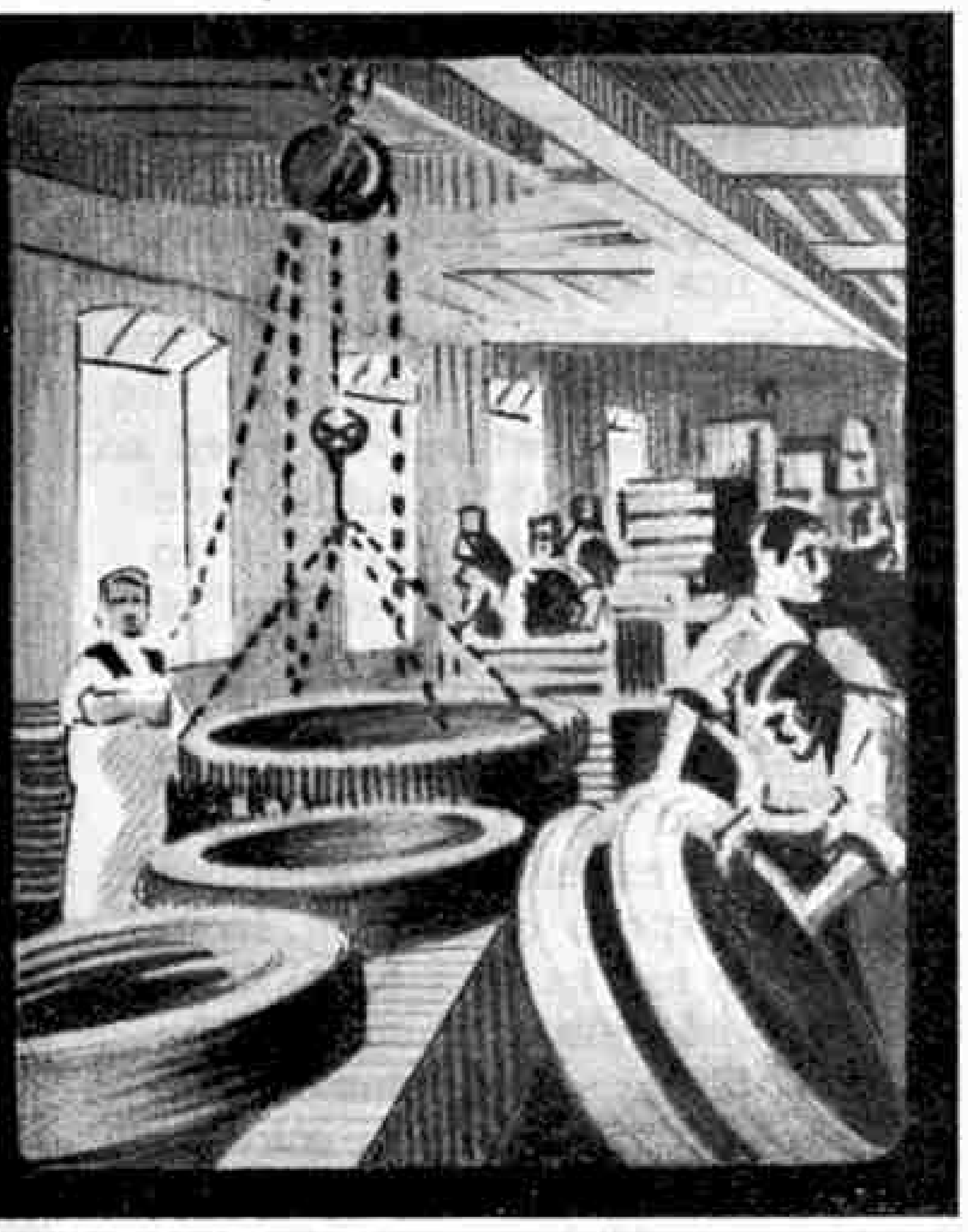
The "*Flora*" was an iron boat of 365 tons displacement, 150 ft. in length, 22 ft. 6 in. in width and 13 ft. in depth. The most remarkable feature of the ship was her screw propellers, this being the first application of twin screws worked independently on the modern principle. Twin screws had been tried before but they had been worked by one motion from the engine, and consequently possessed no increased manœuvring power. Roberts realised that by driving one propeller ahead and one astern a ship could be turned round as if almost on a pivot. The propellers of the "*Flora*" were 7 ft. in diameter, of 14 ft. 6 in. pitch, and were driven by two independent engines having a total of only 120 h.p. Steam was provided by two tubular boilers working at 30 lb. pressure, and one at 50 lb. pressure that served as a superheater.

It was claimed for the "*Flora*" that she possessed a manœuvring power superior to that of any single-screw vessel afloat, and her trials were deemed so important that the Admiralty sent representatives to report on them. At full steam ahead, that is with both propellers working in the same direction and the helm hard over, the "*Flora*" turned in three ship's lengths; but with one propeller working ahead and the other astern she could turn in her own length. The trials of this interesting vessel left permanent results in our own Royal Navy and the Mercantile Marine.

During his association with Sharp, Roberts and Co., Roberts took a great interest in the training of his apprentices and spent many hours in giving them instruction in their trade. Perhaps the most eloquent testimony to this deep-rooted interest is seen in the numerous beautiful models that he built to illustrate in the most effective manner the scientific principles that he sought to convey. The writer has been privileged to handle some of these models. Even such a subject as the shape of a wagon wheel came in for notice, and a little model was made to show the advantage of an axle that could be inclined at a considerable angle from the horizontal. There was also the radiograph, a small model mounted on a wooden frame, the precursor of the speedometer, showing how the revolutions of wheel spokes could be counted while the wheel was running at the highest velocity. But the model that would appeal most to Meccano boys was one of a centrifugal railway, the carriages of which could be filled with water and driven at a high speed. On one section of the track they travelled upside down without spilling the water!

Roberts died on 11th March, 1864, at the age of 75 years. If ever a man may be said to have died in harness, it was he. There was no weakening of that marvellous brain until the very end, and on the day before he died he dictated to his daughter a specification for the improvement of sewing machines! It is almost impossible to estimate the value of the vast number of improvements brought about by Roberts. In almost every branch of industry that he concerned himself with he astounded the specialists by his versatility, and his brilliant and quick-acting mind enabled him to take giant strides where other men were creeping.

THE STORY OF RUBBER



I.—A USELESS GUM BECOMES A COMMERCIAL PRODUCT

LESS than 150 years ago rubber was known to most of the world only as the sap of a tree that grew in certain tropical regions where the inhabitants put the liquid to strange uses. To-day rubber is a commercial product of world-wide importance, cultivated on a vast and still increasing scale, and utilised in a remarkable variety of industries. The rise to commercial importance of rubber is unequalled by any other substance of vegetable origin, with the exception of coal.

Scene on a Rubber Estate at Singapore

Columbus apparently was the first to bring to Europe news of the existence of rubber. When he returned to Spain in 1493 after his second voyage of discovery during which he visited and colonised some of the islands of the West Indies, Columbus described certain trees on the islands that yielded a milky gum which the natives collected, shaped roughly into balls and allowed to harden. These balls had considerable bounce and were used in games. Although this account was confirmed by his crew it was not taken seriously in Spain, as it was regarded as too fantastic to be true.

Courtesy] [The Rubber Growers' Assn., Inc.

A Rubber Plantation in Malaya, showing a Native tapping a Rubber Tree

When the Portuguese captured Brazil in 1500 they found that rubber syringes or squirts were in common use by the natives. Twenty-five years afterwards, these observations of the Portuguese were confirmed by Spanish adventurers who visited South America.

Almost a century later, a Spaniard named Juan de Torquemada visited Brazil and Mexico, and in a record of his travels that he published at Madrid in 1615 he says:—"There is a tree which the natives call *Ulequahuitl*; it is held in great estimation and grows in the hot country. It is not a very great tree; the leaves are round and of an ashy colour. This tree yields a white milky substance, thick and gummy and in great abundance." Torquemada adds that the juice was collected and allowed to settle in calabashes and was then softened in hot water, or was smeared over the bodies of the collectors and rubbed off when sufficiently dry. He mentions various uses to which the juice of the "Ule" tree was put by the people. The Spaniards "waterproofed" their cloaks by coating them with the juice; it was drunk with cocoa to stop hæmorrhage, while an oil that was extracted from the rubber by heat was used as a medicament.

The first accurate information respecting rubber-bearing trees was brought to Europe by La Condamine, one of the two leaders of a French Geographical Expedition that was sent to South America in 1731, by the French Academy of Science. On the return of the expedition, about 1735, La Condamine presented to the Academy specimens of rubber that he had obtained in Ecuador, and compiled a report on the rubber trees of South America and the various uses of rubber by the South American Indians. The Indians of Ecuador and Para called the substance "caucho," or "cahucha," and the present-day name "Caoutchouc"—a technical term for rubber—is derived from these two words.

In 1755 the King of Portugal sent several pairs of his boots to Brazil to be treated with rubber to make them waterproof, and in 1759 the Government of Para presented to the Portuguese monarch a suit of rubber clothes.

Travellers from the West Indies to England and France confirmed the stories told by Columbus and others, of how the Indians made cloth moderately waterproof by pouring on it the milky gum of the rubber tree, and then allowing the gum to dry. It is probable, also, that they brought with them specimens of such cloth. The subject aroused more and more interest, and during the second half of the 18th century certain French chemists began to experiment with rubber with a view to finding out whether it could be put to any commercial use. In England, however, rubber continued to be regarded by scientists and public merely as a curiosity.

It is not known who discovered that rubber could be used as an eraser, but in this guise it was on sale in a London shop in 1770. One day it attracted the attention of Dr. Priestley, the famous chemist who discovered oxygen. He became so interested in the eraser that he added the following note respecting it to the preface of his book, "*A Familiar Introduction to the Theory and Practice of Perspective*."—" Since this work was printed off, I have seen a substance excellently adapted to the purpose of wiping from paper the marks of a black-lead pencil. It must, therefore, be of singular use to those who practise drawing. It is sold by Mr. Nairne, Mathematical Instrument Maker, opposite the Royal Exchange. He sells a cubical piece of about half an inch for three shillings; and he says it will last several years."

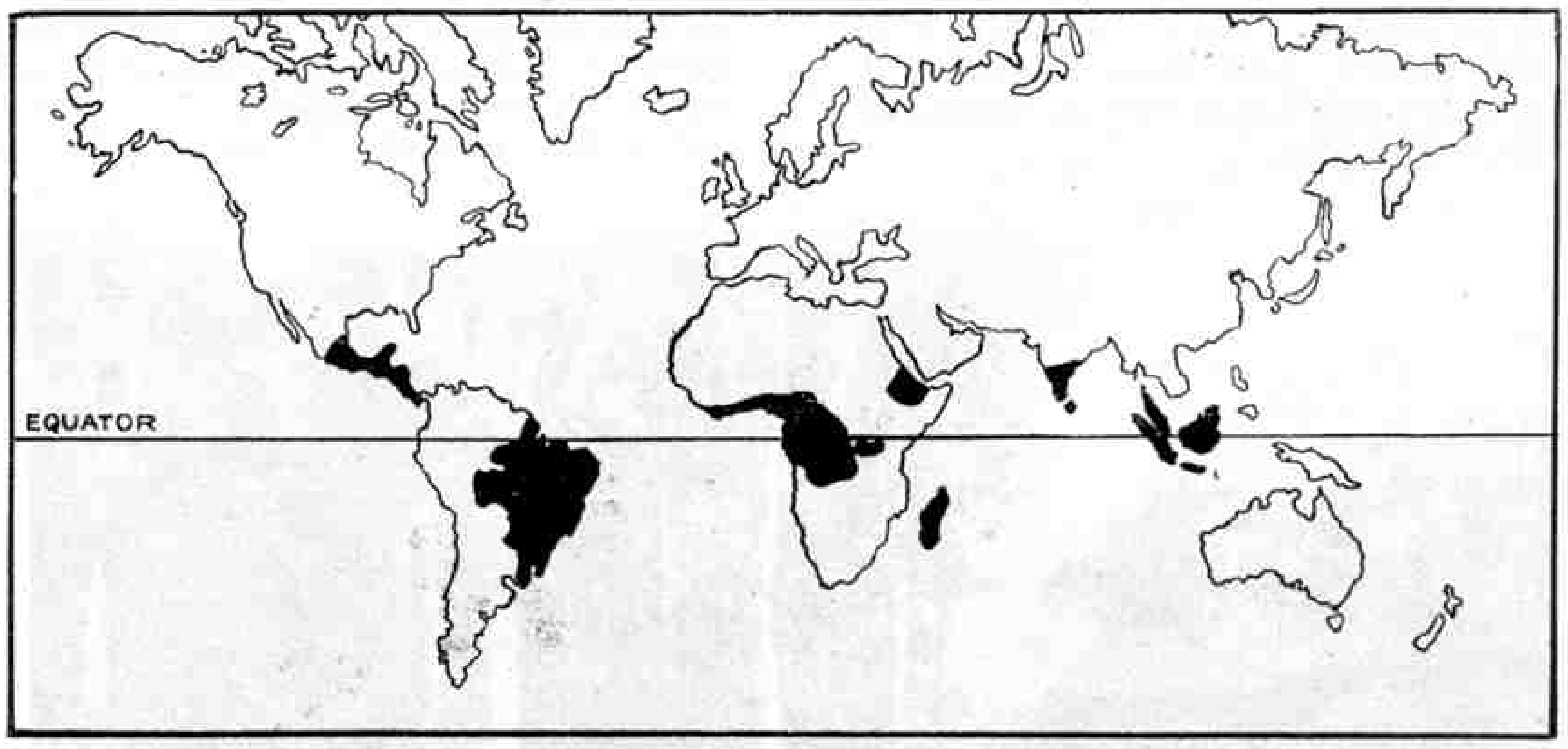
Courtesy] [*The Rubber Growers' Assn. Inc.*

Sir Henry A. Wickham standing beside the largest original rubber tree in Ceylon

Although French chemists were the first to carry out serious experiments with rubber, English investigators soon made up the lost ground. As early as May 1791, an Englishman named Samuel Peal was granted a patent for a method of making " perfectly waterproof all kinds of leather, cotton, linen and woollen cloths, etc." Peal's method was to spread a layer of prepared rubber on the outer side of a single layer of the fabric, the coating consisting of indiarubber dissolved " by distillation or by infusion in other spirits, and in most kinds of oil or in Indian rubber used in its native fluid state."

Although Peal claimed that his method was perfect, it did not prove a success, as the treated garments were found to be greatly affected by seasonal changes of temperature. In cold weather the rubber covering hardened, while in hot weather it softened, melted and fell apart. Further disadvantages were that the rubber had a very unpleasant odour, and when soft was disagreeably sticky. Various scientists endeavoured to solve the problem of drying up the rubber and preventing this stickiness, but for a time all their efforts proved to be in vain.

In consequence of these serious defects, rubber became very unpopular. Traders from the West Indies, who were shipping raw rubber to this country in increasing quantity, had difficulty in selling it. By 1820, the imports of rubber to England were so large, and the known use for the substance so small, that it was almost unmarketable. As a result unsold stocks of rubber frequently had to be retained on the ships and used as ballast.



Map showing in black the principal Rubber Producing Areas of the World

Some doubt exists as to the date and locality of the first rubber factory in the world, but it seems probable that this was a small works established about 1803 in the suburbs of St. Denis, near Paris. This factory belonged to an Austrian who had invented " rubber threads for use in suspenders." At that period most inventors interested in rubber were concerned in seeking for a means of rendering it impervious to changes of temperature rather than in devising new uses for it. Some measure of success was achieved in 1823 by a Glasgow chemist named Charles Macintosh, who invented what was at first called " double texture waterproof cloth," and later was named after him.

The process patented by Macintosh consisted of " dissolving thin sheets of rubber in naphtha, spreading the solution so obtained on a marble slab, allowing the solvent to evaporate, and then placing the thin sheet of rubber so obtained on the textile material, to which it was fastened by means of needle and thread." The rubber covering, or " proofed " side of the cloth was very sticky, and Macintosh overcame this nuisance by covering the exposed side of the rubber sheet with a layer of cloth. By this means the rubber was neatly sandwiched between two layers of fabric, and the double-texture cloth so formed was made up into coats that became known as "macintoshes."

At first the Macintosh factory did big business, but in time it became clear that, although the inventor had contrived a waterproof garment in which the rubber was carefully screened from exposure to the air, the rubber was still susceptible to heat and cold. Scientists and inventors now began to realise that, until this problem of liability to change with atmospheric conditions was overcome, rubber was of little practical use. Many men in various parts of the world set to work upon the problem, and in 1839 success came to an American named Charles Goodyear, after many years of patient investigation and experiment.

Goodyear was a hardware merchant, who stocked his store in Philadelphia with goods manufactured by his father. For a time he prospered, but eventually he got into financial difficulties as a result of giving credit on too large a scale. He was unable to pay his debts, and in accordance with the law of that time he was imprisoned. In spite of his troubles, Goodyear never lost heart. He had his little work bench brought to the gaol, and he laboured there to complete certain inventions which, he believed, would bring him sufficient money to pay his debts. He could have found relief by declaring himself bankrupt, but this he obstinately refused to do, and although he was not long in prison on this occasion, he was re-imprisoned time after time during the next ten years.

The story goes that one day Goodyear had occasion to visit a store room containing various kinds of goods made of rubber. His attention was attracted by some life preservers, and on examining them he found that they were defective. He said nothing at the time, but returned a few days later and offered the merchant a new and more effective tube for inflating the preservers. The merchant quickly realised the ingenuity of Goodyear's improvement, and in the course of conversation referred to the urgent necessity of some method being found to prevent rubber from deteriorating in hot weather. The merchant went on to say that unless some method of doing this could be found before long, his business would have to close down.

The problem made an immediate appeal to Goodyear, and the more he thought about it the more it attracted him. His inventive ability lay less in producing new things than in improving those already existing. As he once remarked to a friend, "I long to make poor clumsy things better. They seem to cry out to be improved."

Charles Goodyear, the Discoverer of the Dry Heat Process of Vulcanisation, in 1839

Goodyear set to work with enthusiasm, but with little knowledge and less equipment. His first experiment consisted of mixing some rubber gum with turpentine. This mixture was then placed on pieces of flannel and, by means of his wife's rolling pin, was rolled out into thin sheets that adhered to the fabric. He then made up the rubber-covered material into shoes and set them aside to await warm weather. When this arrived he was disappointed to find that the rubber became very sticky. The idea occurred to him that possibly the stickiness was due to the turpentine, and he therefore obtained a cask of rubber gum diluted with alcohol. An amusing incident that occurred very soon after the cask arrived spared him the necessity of experimenting with this gum.

At that time the inventor had an Irish assistant named Jerry, who was greatly interested in the strange liquid in the cask. He remembered seeing Goodyear coat pieces of flannel with gum, and he decided to experiment with the new liquid. He first coated his overalls with it and the result seemed perfectly satisfactory. Jerry then put on his overalls and sat down before the fire to stir the gum preparation ready for Goodyear's experiments. Presently he tried to get up, but found to his dismay that he was unable to move. The gum had fastened him securely to the chair, and there he had to remain until Goodyear arrived and freed him!

View of a Rubber Plantation in Malaya. The three photographs on this page are reproduced by courtesy of the Rubber Growers' Association, Inc.

Subsequently Goodyear carried out experiment after experiment with rubber mixed with various chemicals, but in every case without success. His friends tried to persuade him that he was wasting his time, but the only result of their efforts was to make him more determined than ever. His prolonged experiments impoverished his family, and the rent of the cottage often had to be paid for by the sale of some article of furniture. He became a shabby figure whose clothing always seemed to be covered with bits of rubber. The story is told that about this time someone asked how he would be able to recognise Goodyear if he met him. The reply was "If you meet a man who has on an indiarubber cap, stock, coat, vest and shoes, with an indiarubber money purse without a cent of money in it, that is he."

During 1838, Goodyear made the acquaintance of a man named Nathaniel Hayward, who had been foreman of a rubber company that had failed. The two men became friends, and Goodyear then learned that Hayward had taken out a patent for a process of treating rubber with sulphur. In this process, articles made of raw rubber were coated with a small quantity of sulphur and then placed in the sun to dry. This treatment had the effect of partially hardening the rubber and eliminating its stickiness. Goodyear immediately began to experiment on similar lines, and soon found that the process was only practicable when applied to a thin rubber surface. He realised that the problem could not be considered solved until a method had been found of rendering any thickness of rubber impervious to seasonal changes of temperature. At the same time he believed that the solution might be found along these lines, and he therefore purchased Hayward's patent so as to use the process as a basis for further experiments.

Charles Macintosh, F.R.S., who in 1823 invented a Process of Waterproofing with Rubber

There are different versions of the circumstances in which Goodyear made the discovery in 1839 that brought success. According to one account he was seated in the kitchen holding before the stove a piece of rubber mixed with sulphur, so that he might observe how the heat affected the substance. In emphasising a remark to his family he made a gesture with his hand, thus causing the rubber to come into contact with the stove. When he looked at the material he found that a wonderful thing had happened. Instead of melting, the rubber had charred like leather. All traces of stickiness had disappeared, while at the same time the rubber was soft but had not lost shape. Goodyear was greatly astonished and, quickly heating another piece of rubber in the same way, he nailed it outside the kitchen door. Next morning he went out to inspect the substance, half expecting to find that the intense cold had completely hardened it; but to his great joy the rubber was as dry and flexible as when he had nailed it to the door.

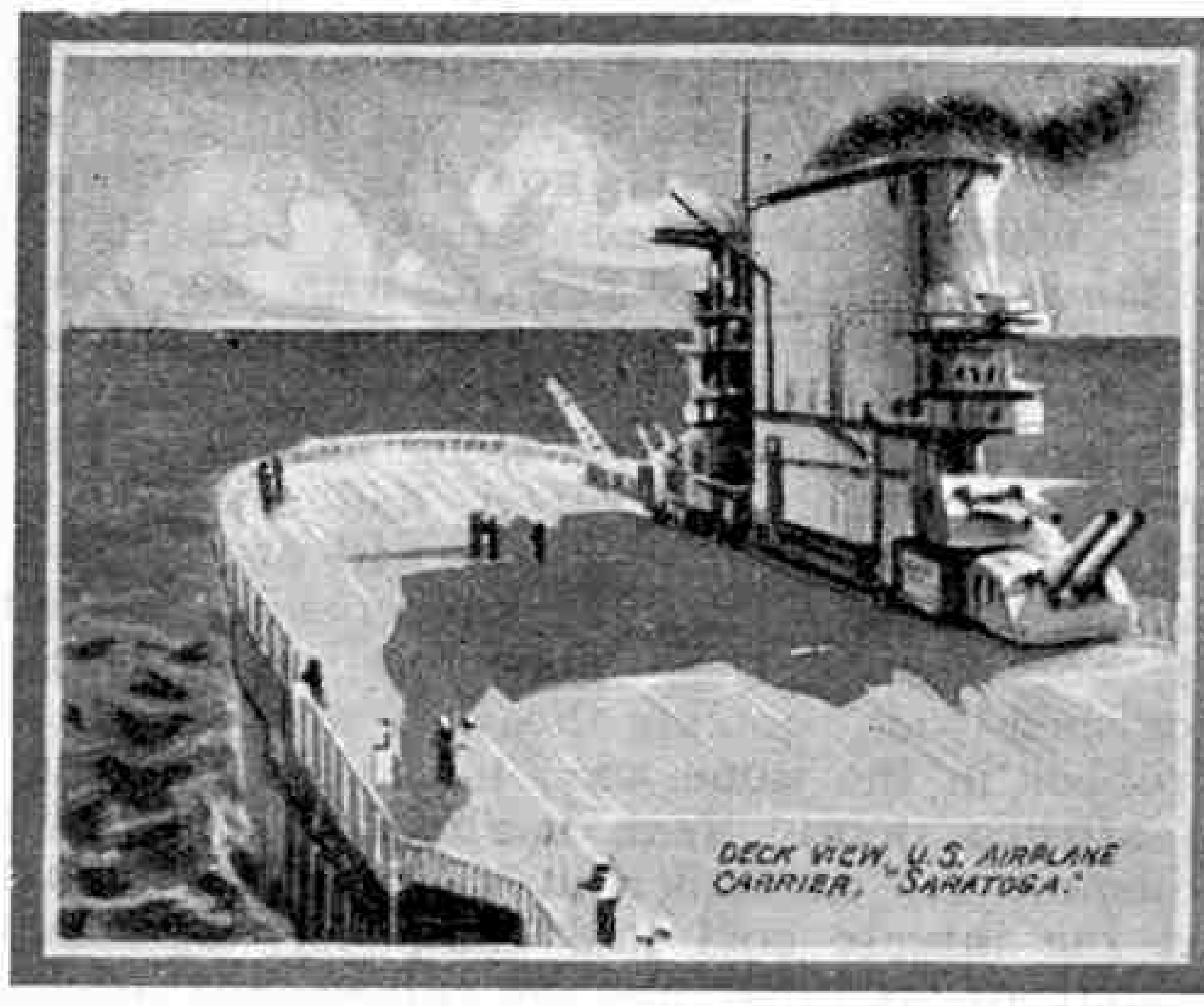
Goodyear then carried out further tests to ascertain the effect on the new substance of varying degrees of heat and cold, and also to discover the exact degree of heat that yielded the best result. When he had satisfied himself on these points he obtained a patent for his invention, and in 1841 a factory was established at Springfield, Mass., for the treatment of raw rubber by the new method and for the manufacture of rubber goods from the treated material. Goodyear's process of heating the rubber with sulphur under carefully regulated conditions is now known as "Vulcanisation" and it has made possible the use of rubber for a remarkable variety of purposes, some of which we shall describe later.

Shortly afterward the same process of vulcanisation was discovered independently by a man named Hancock, who was a partner in the firm of Macintosh already mentioned. By an arrangement with the company his process was adopted by them for the manufacture of waterproofs. At that time the treated rubber was spread upon the fabric by hand, and the coated material then passed between warm rollers so as to obtain a thin surface of rubber. This process was slow and laborious, and Hancock set himself to improve upon the method. In his private laboratory he devised a machine for softening the raw rubber and for spreading the masticated dough of rubber upon the fabric. His first experimental machine had a capacity of one pound of raw rubber, but several years later he built a masticator, as his machine was called, capable of holding as much as 200 lb. of rubber.

Goodyear and Hancock converted rubber from an unstable substance to a commodity of great commercial importance and their success marked the real beginning of the rubber industry.

The early rubber companies that came into being were dependent upon the wild rubber trees of South America for their supplies of raw material. This state of affairs prevailed until the early seventies of last century, when the India Office enlisted the services of the Royal Botanical Gardens, Kew, to assist in introducing to India rubber and other useful economic plants from foreign countries. It was due to the splendid pioneer work of Sir Henry Wickham that the rubber industry became established in Malaya, Ceylon and India, and the benefit derived by the British rubber manufacturing companies of to-day from these sources of supply is incalculable.

Next month we shall relate how Sir Henry Wickham transported seeds of the South American wild rubber trees to England for despatch to India, and also describe the work carried out at a modern rubber plantation.

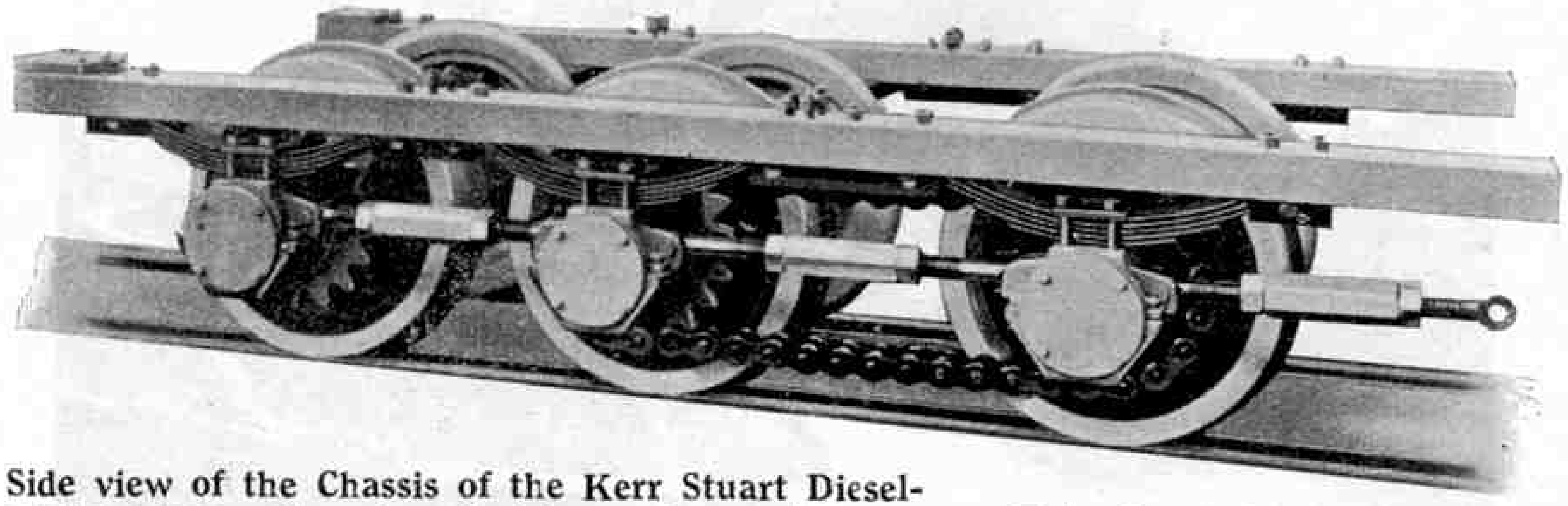

DECK VIEW, U.S. AIRPLANE CARRIER, "SARATOGA."

ENGINEERING NEWS

Corrosion of Metals by Sea-water

Interesting experiments on the corrosion of metals by sea-water have been completed in the British Channel. Four years ago bars of various metals and alloys were mounted in a wooden frame that was bolted to concrete blocks on the rocky sea bottom off Weston-super-Mare. Except at the lowest of neap tides the bars were continually covered with seaweed, and there was nothing to hinder their corrosion. As a result it is now possible to arrange them in order of merit as far as resistance to sea-water is concerned.

Wrought iron and mild steel came out of the test fairly well. The bars of these alloys were severely rusted and had lost one-twentieth of their weight, but their strength was unaffected. Stainless steel resisted corrosion much better. Large areas of the surface of this metal still had a polished appearance after four years in the water, a splendid testimonial to the value of this alloy of iron and chromium.



Side view of the Chassis of the Kerr Stuart Diesel-engined locomotive, described in our issue of January. This chassis has an interesting chain drive from the centre to the trailing wheels

The aluminium bar showed up very badly. Its surface had deep holes, and it had lost almost as great a proportion of its weight as the iron and steel. A still more serious change was the loss in tensile strength, which amounted to almost 16 per cent. This explains why the metal has proved to be unsuitable for use in marine engineering.

Copper is a metal of special interest, as it was very largely used for sheathing the hulls of wooden vessels during last century. To describe a ship, or in fact anything, as "copper-bottomed" was almost the same as speaking of it as "A.1 at Lloyds!" The bars of this metal lost almost four per cent. of their weight during four years' immersion, and there was also a loss in tensile strength. The addition of less than two per cent. of nickel made a surprising difference. A bar made of this alloy lost three per cent. of its weight, but the reduction in tensile strength was only one-third of that suffered by ordinary copper.

Tin, lead and nickel came out of the ordeal with flying colours. In the case of tin the loss in weight was less than one-twentieth of one per cent., and the other two metals behaved almost equally well. This suggests that in future attention should be turned to alloys of these three metals, as they seem to offer a good prospect of discovering a metal that resists corrosion completely.

Mass Painting!

The task of painting the Quebec Bridge, the largest cantilever bridge in the world, is probably unique in its extent. No less than 7,800 gallons of paint are required to give the bridge one coat. Seventy gallons are needed to cover once each of the four main posts; that is 280 gallons in all for the posts alone. The application of a single coat of paint to the entire structure necessitates the united efforts of 35 men, working steadily from 15th June to 15th September each year over a three-year period. At the same time the bridge is inspected and the movable parts are greased and oiled.

The painting and maintenance of the bridge involves many problems, for the bridge is exposed to great extremes of temperature—90 degrees maximum, and 31 degrees below zero minimum. Problems in spray-painting are also experienced, for the men must work sometimes from 200 to 300 ft. above the level of the water, and also, always in a high wind. The paint was formerly applied by a brush-painting gang of 18 men, but spray-gun equipment has now been introduced.

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Large Draglines for India

Two large excavators for irrigation work in India have recently been completed by Ruston and Hornsby Ltd., of Lincoln. This firm have already supplied many monster draglines for Indian work. The two new draglines are practically identical in general design, but while one has a jib 100 ft. in length, capable of being extended to 115 ft., the jib of the other is only 60 ft. in length. Large caterpillar tracks are fitted to each of the machines, and even when the jib is at right angles to the dragline, and is carrying the maximum load, the pressure on the ground at any point does not exceed 3,500 lb. per sq. foot. The larger machine is 240 tons in total weight and is capable of digging to a depth of 50 ft. when the jib extension is employed. Material can be dumped to a height of 40 ft.

Heightening the Aswan Dam

It has been decided by the Egyptian irrigation authorities that a second heightening of the Aswan Dam is now necessary. The first heightening was completed in 1912, but since then a demand for an additional 13,000 million cubic metres of water has arisen, the present supply being especially insufficient during the dry period between the beginning of January and the end of June. In order partially to meet the demand this new scheme has been deemed advisable.

In addition to the heightening of the dam, the newly-authorised scheme also includes the construction of a reservoir at the ancient city of Gebel, these two undertakings providing 4,400 million cubic metres of the total amount required. The remaining 8,600 million cubic metres of water will be obtained from projects to be undertaken on the Sudd and at Lake Albert.

Of the 4,400 million cubic metres of water that are being provided by the Aswan and Gebel works, 1,400 million cubic metres will be devoted to the improvement of agriculture in areas already under irrigation. The remaining 3,000 million cubic metres will be utilised for the reclamation of an area of uncultivated land in Lower Egypt, and also to make possible the perennial cultivation of a district in Upper Egypt, where previously crops could not be grown during the dry season. The total cost of the scheme is expected to be approximately £E.24,000,000.

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German Mountain-Top Hotel

A very remarkable hotel has recently been constructed in Germany. It is situated on the absolute summit of the Zugspitze, one of the highest mountains in Germany, and is over two miles above sea level. It is naturally somewhat small, having accommodation for 73 persons. The building is of wood, and six months were occupied in its erection. Parties of 80 men were employed at a time, and they worked in weekly shifts on account of the severity of the weather conditions.

Before the building of the hotel could be commenced, it was necessary to construct an aerial cable-way from a station in Austria, 2,800 ft. above sea level, to the top of the mountain, 11,000 ft. in height. The cost of the hotel and the cable-way was approximately £200,000.

London Underground Train Recording Clocks

In the article on the new Piccadilly Circus Tube Station, in last month's "*M.M.*," reference was made to the set of train-recording clocks installed. The set includes six clocks, one for each of the six London Underground systems—the District, City, Central London, Bakerloo, Piccadilly and Hampstead railways.

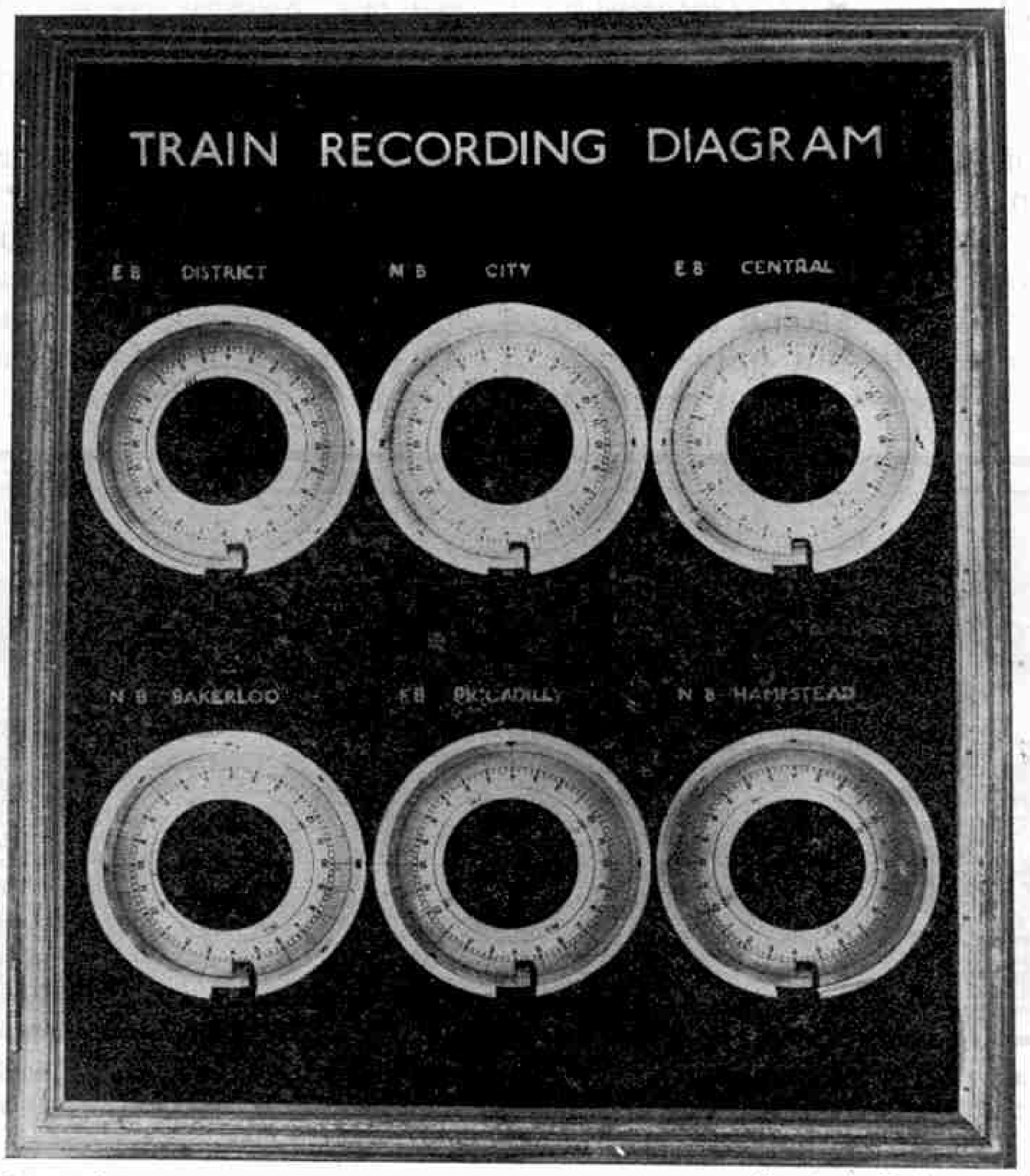
The face of each clock consists of a paper dial covering 24 hours, one half of the dial being graduated to show the 12 hours "a.m." and the other half the 12 hours "p.m.," each hour space being divided by dots into quarter hours. Each dial rotates at the equivalent speed of an ordinary clock, and its position in relation to the tiny ink hammer that records upon it is such that the clock can be read also as a timepiece.

When a train enters the section of route that is covered by one of these clocks, it automatically operates the contact lever of the electric signalling system, and an electrical impulse is transmitted simultaneously to the clock. This impulse causes the ink hammer to strike the fringe of the dial, and the position of the mark so made, in relation to the hour markings on the dial, shows the time at which the train passed the recording point on the route. As the hours go by, the fringe of the moving dial bears an increasing number of fine markings. If these are equidistantly spaced they show that the trains are running to schedule; but if the service is not working smoothly, gaps appear on the dial. A suicide on the line at Hyde Park Corner recently disorganised the Piccadilly service from 4.30 p.m. until 8.0 p.m. This prolonged irregularity was registered clearly on the dials of the train-recording clocks on this route, a wide gap followed by numerous irregularities in the markings being shown between the times mentioned.

The fineness of the markings made by the hammer can be gauged from the fact that, during the 19 hours of each day that trains are running on the London Underground systems, the number of trains in one direction on the District Railway totals 552, including as many as 41 per hour during "rush" periods. On the remaining five railways there is an average of 427 trains daily.

The dials of the clocks are examined frequently by the officials concerned with traffic working. At the close of each day the dials are replaced by new ones, and the used diagrams, bearing a record of the whole day's working, are sent to the head office of the company where they are examined along with the guards' journals and the signalmen's reports for the same day.

Although the clocks record faithfully any irregularities of the train services, they do not explain the cause of the derangements. It is proposed to overcome this disadvantage by installing in conjunction with each clock a machine that will set out particulars of the incident causing the dislocation of traffic; stating where the trouble is, what has occurred, and indicating what changes are necessary to remedy it. These news recording instruments will be installed at all the depots on the London Underground systems so that the engineering and operating staffs will be informed at once, and simultaneously, of the circumstances of any dislocation of traffic. The instruments will be operated from the Controller's offices at Leicester Square for the Tube Railways, and at Earl's Court for the District Railway. These clocks form an example of the way in which the London Underground Railways maintain the high standard of efficiency for which they have always been noted.



Courtesy] [London's Underground

Recording clocks of the London Underground at Piccadilly Circus

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The Leaning Tower of Pisa

The famous leaning tower of Pisa is now leaning so much that fears for its safety have been expressed. A hundred years ago the top of the tower was 15 ft. 6 in. out of the perpendicular, but during the past century the tower has leaned over another foot. Unfortunately, the foundation of the famous building is only 10 ft. in depth, and as it was quite clear that drastic steps would be necessary in order to prevent the collapse of the structure, it was decided to force concrete under the walls. This work is now proceeding, and according to reports that have been issued, the contract for this work has been secured by the British Cementation Company.

The tower is 179 ft. in height and has eight storeys. It is constructed throughout of marble, and at its base the walls are 13 ft. in thickness. Its peculiarity has given rise to many stories, but it is now believed that it was not originally intended to be a leaning structure, but that the leaning position was assumed during its erection 800 years ago.

New White Star Motor Ship

A new 27,000-ton motor ship is now approaching completion in the Belfast yards of Harland and Wolff. The vessel is being constructed for the White Star Line, and it is to be named "*Britannic,*" being the third White Star ship to bear this name. It is interesting to note that the two earlier "*Britannic's*" also were built by Harland and Wolff.

The first "*Britannic*" was a fast and popular passenger ship of 5,000 tons, built in 1873. Although she was a single-screw vessel, her splendid lines and powerful engines enabled her to break the existing trans-Atlantic record with a crossing of 7 days, 12 hours, 47 minutes, between Liverpool and New York. She was 467 ft. in length with a 45 ft. beam, and carried a spread of canvas that helped to make her steady, and also added slightly to her speed when the wind was favourable. She had two funnels and four masts.

This famous liner made 270 round trips between Liverpool and New York, covering about 2,000,000 statute miles. In this uninterrupted service she consumed nearly 600,000 tons of coal. The company's booking records show that the ship transported between the Old World and the New a total of 112,711 first-class and 282,685 third-class passengers. During the Boer War she was known as "Transport No. 62." In this service she made eleven trips to Capetown, covering 200,000 statute miles and transporting 20,728 troops.

The second "*Britannic*" had no opportunity to show her worth. She was launched on 26th February, 1914, and a year later was commissioned as a hospital ship. After barely a year's service in this capacity, she was mined in the Aegean Sea.

We hope to publish photographs and particulars of the latest "*Britannic*" in an early issue of the "*M.M.*"

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World's Longest Suspension Bridge

Work on the world's longest suspension bridge, joining Fort Washington in New York City and Fort Lee in New Jersey, across the River Hudson, is proceeding rapidly, and it is hoped that the structure will be completed by 1932.

The span of the completed bridge will be 3,500 ft.—almost twice the length of the "Ambassador" bridge mentioned in last month's "*M.M.*"—and the cable towers will be 635 ft. in total height. The cables will be capable of carrying a load of 350,000 tons and it has been estimated that approximately 19,000,000 passengers in 8,148,000 vehicles, 1,500,000 pedestrians, and 500,000 buses will cross the bridge during the first year that it is in operation.

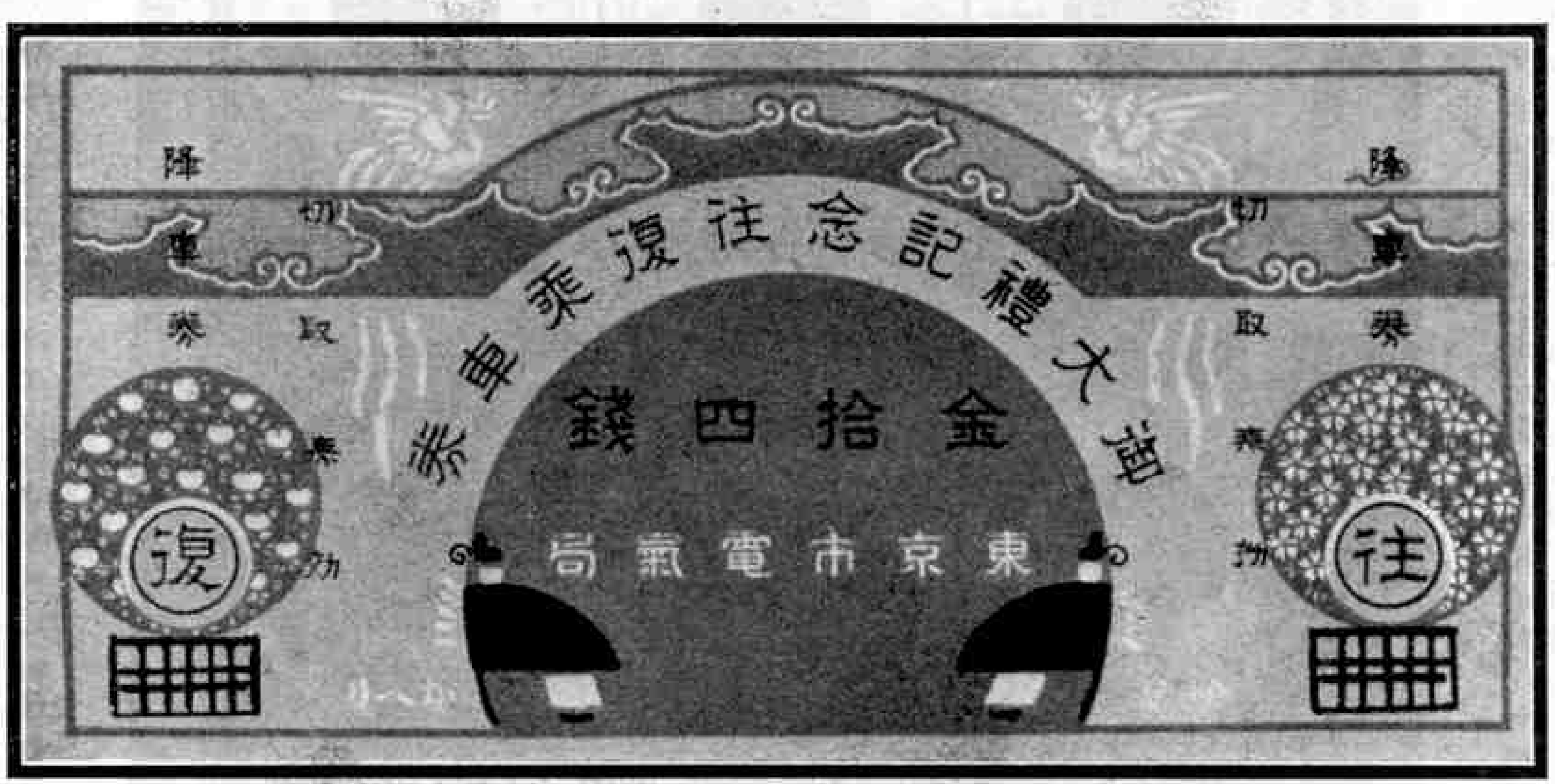
The bridge will accommodate 14 streams of traffic, and will have two sidewalks and four electrified railway tracks. The total cost will be approximately £20,000,000. Readers will recollect that a full description of this wonderful bridge appeared in our May 1928 issue.

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Eighty Million People Cheer an Emperor

I and other schoolboys of Japan greatly enjoyed the enthronement of our Emperor, which took place on 10th November last year, for we had quite a crop of holidays during the ceremonies that took place both before and after this event. We did attend school on the day of the actual enthronement—but only for the purpose of giving three cheers. These were not ordinary cheers, however, but marked the conclusion of an important part of the ceremony. The signal for them was given at three o'clock in the afternoon by no less a person than the Prime Minister of Japan, who stepped into the Court of the royal Palace at Kyoto and shouted "*Banzai*" three times. The crowds assembled around the Palace and in the streets followed his example, and at exactly the same time similar cheers were given by the people in every city and village in Japan. It was quite thrilling to realise that I was one of a cheering nation of more than 80,000,000 people!



Special tram ticket issued in Tokyo during the ceremonies associated with the recent enthronement of the new Emperor of Japan. It is a return ticket and is attractively printed in several colours

I noticed that many English and foreign papers described the ceremony as a "crowning." This is wrong, however, because the Japanese Emperor is not crowned but simply stands up before his subjects and formally declares himself enthroned by his own right.

As may be imagined, there were great rejoicings throughout the whole of Japan, and the streets of our cities were gaily decorated. In common with all my schoolfellows, I received a medal to commemorate the event, and sets of stamps, and even tram tickets, were also issued in connection with the celebrations.

K. Yoshida (Tokyo).

Fighting the Tsetse Fly

One of the greatest enemies of human life is the tsetse fly, which has devastated large areas of tropical Africa. This insect is a carrier of the dreaded disease known as "sleeping sickness," and it can only be fought by the drastic method of firing large sections of the bush and the native villages in which it has established itself. In Uganda the fight has already been won, and the natives now grow cotton on land that was formerly covered with bush and scrub in which the disease-carrying pest found shelter.

In other parts of East Africa the struggle continues, and "firing parties" may still be seen hunting and slaying the deadly insect. The number of fly hunters in a party is usually about 100, and they are under the command of a European doctor. They are very quaintly dressed. All wear long trousers held tightly to the ankle by elastic bands, and veils hang from the brims of their helmets. Each man carries a butterfly net and a jar that contains a fly-killing preparation.

When the party reaches a fly-infested village, the inhabitants are cleared out. The men then light torches, spread out in a long line before the village and sweep past it into the bush, setting fire to the dry thatches and the sun-scorched vegetation. These readily take fire at a touch from the flaring torches, and thick tongues of flame leap into the air as the wind fans the blaze. Wild creatures of all kinds are stampeded by the fire. Scores of rock-rabbits and rats rush down narrow runways; monkeys jump frantically from branch to branch ahead of the oncoming blaze; while antelopes, barking baboons and even lions may be seen making a dash for safety. Only a few insects remain, buzzing angrily around patches of grass that are too green to burn. The men catch these in their nets and drop them into the poisonous mixture in the jars. They work swiftly and eagerly, for extra pay is given to those who kill the greatest number of flies.

It has taken years of strenuous work to prove that sleeping sickness is carried by the tsetse fly, and experiments on animals are still being made in the hope of finding a sure and certain remedy for the terrible disease. A visit to an East African hospital zoo is very interesting. The animals are kept in hutches and cages that stand in the shade of tall trees, and recruits arrive daily. The doctor who receives them—he is often an Indian surgeon—notes when and where they were captured and rewards the men who have brought them. The animals are treated like patients in the hospital, and the results of various experiments are carefully compared daily. In hospitals of this kind the life history of the parasite that causes sleeping sickness has been worked out, and it is believed that eventually means will be found of rendering it harmless.

W. L. Speight (Capetown).

Visit to an Asbestos Board Factory

Some time ago I had the good fortune to be shown over the works of the Asbestos Products Co. Ltd., Johannesburg. There I saw the interesting process by which asbestos is manufactured into the fire-proof sheets and boards with which we are now familiar.

Raw material comes from mines in Rhodesia and the Transvaal, where it is found in layers several inches in thickness. It is fibrous in structure, and is dug out in sticks that are usually four or five inches in length.

The first step in making asbestos sheet or board is to separate the fibres. For this purpose the sticks are split until they are only a few fibres in thickness, after which they are fed into a large mixing bin that revolves on a vertical axis. By continual stirring the long fibres are pulled apart and interlaced into a fluffy mass. They are then cleaned. For this purpose a giant vacuum cleaner is used, and when the asbestos emerges it is ready for the actual manufacture into sheets and boards.

The clean fibres are placed in a drum and Portland cement is poured on top of them. The drum is then rapidly revolved until the fibres and the cement are thoroughly mixed together, after which the contents are poured into a vat and a proportion of water added.

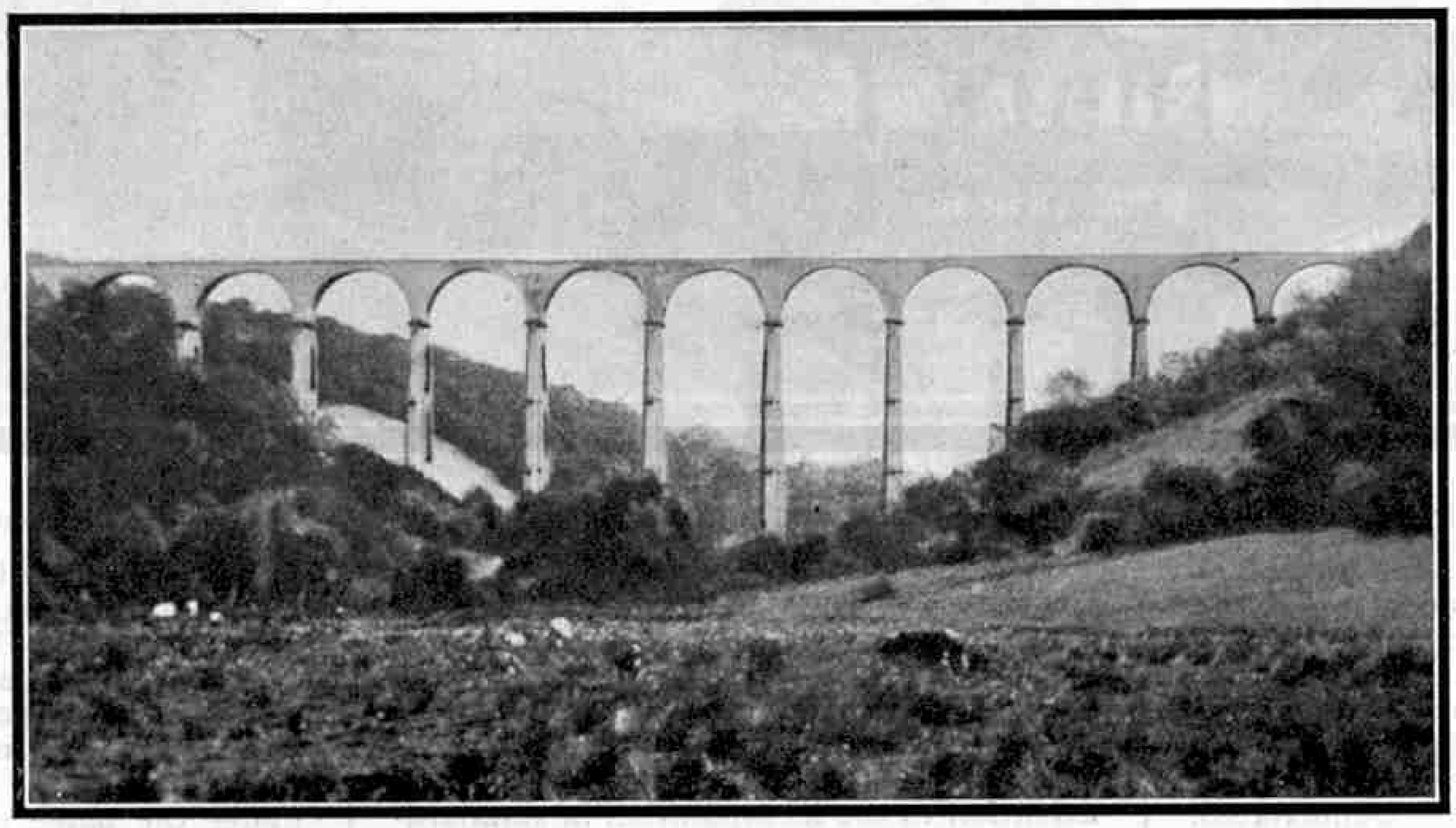
The thick slime thus made is carried by a felt conveyor belt to the circumference of a slowly rotating drum about 4 ft. in diameter, where it is evenly distributed under a pressure of 40 lbs. per sq. in. The drum rotates and the deposit slowly grows until its thickness is half that of the required sheet. A warning bell then rings; the machine is stopped, and wire netting is wrapped round the layer on the drum in order to form a reinforcement for the board. When the wire is in position the machine is started again, and the deposition of the asbestos pulp continued. At the end of the process the layer of damp asbestos board is cut, rolled out flat on a bench, and shaped.

If corrugated sheet is required the board is pressed to shape while still damp on sheets of corrugated iron, while roof guttering and other specially shaped boards are similarly pressed on moulds. The sheets are then left for three or four weeks to dry, after which they are ready for use.

P. DALLAMORE (Johannesburg).

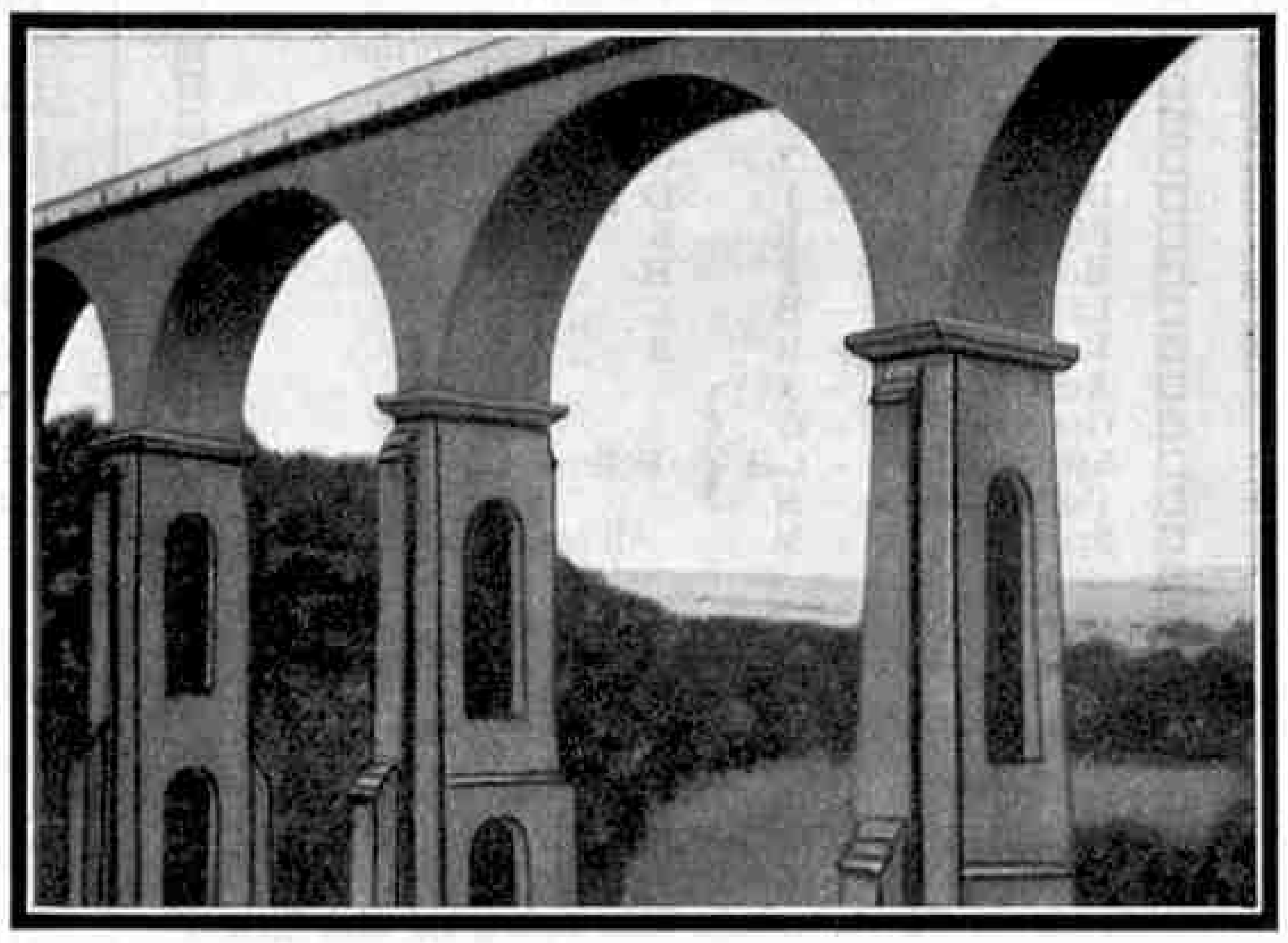
Howns Gill Bridge

Howns Gill Bridge is a lofty and graceful structure that crosses one of the most beautiful gills or ravines in North-West Durham. It was built in 1856 to carry a single line of rails across the Gill. Its length is 700 ft. and the parapet is 175 ft. above the lowest point of the ground beneath it. Each of the 12 arches of which it consists has a span of 50 ft.



The graceful railway bridge shown in our photograph spans Howns Gill, a ravine in north-west Durham, and has been in regular use since 1856

The structure of the bridge is of great interest, for it is "barrel arched." This means that it is arched at the top and also at the bottom. The sandy soil of the Gill is not an ideal foundation, and a larger base was necessary than would have been the case on rock or firmer soil. The peculiar system of construction has enabled the weight of the bridge to be distributed over a larger area, and with the same purpose in view the masonry of the bridge has been made much wider at the bottom than at the top. The work of erection was completed in 15 months, and the cost of the bridge was £14,000.



Another view of Howns Gill Bridge. The parapet is 175 ft. above the bottom of the Gill

In the early days of railways a coal line was constructed across the Gill, the traffic being worked up its steep slopes by a stationary engine and cable. Wagons were carried across on a bogie that had two small and two large wheels. When descending, the smaller wheels were at the rear, but it was necessary to turn the bogie round in order to keep the platform horizontal during an ascent. On arrival of a train at the top of one of the slopes each wagon in turn was run on the bogie, which was then lowered down one side of the Gill and reversed on a turntable before being hauled up the slope on the opposite side.

When the railway became a passenger line, trains stopped at the top of the slope and the passengers alighted. They made their way across the Gill on foot, stone steps being provided to assist their progress, and on climbing the opposite side to that on which they arrived they found a second train waiting them. As traffic increased, the delay and inconvenience became so great that it was decided to build a bridge, and the beautiful structure that is still standing was then erected. It is interesting to note that the contractor responsible for its erection wished to make it 10 ft. higher in order to reduce the amount of excavation necessary, but this the architects would not permit.

HARRY RUTTER (Consett).

A Miniature Airship

A non-rigid airship of unusually small dimensions has been constructed in America by the Meadowcraft Balloon and Airship Company. The ship is 65 ft. in total length and 30 ft. in diameter, and it has a displacement of 22,000 cu. ft. Its weight unloaded is 800 lb. and a useful load of 500 lb. can be accommodated. During preliminary trials, a speed of 20 miles an hour was developed with a 22 h.p. engine.

The airship is divided into two lobes, and an ingenious method of regulating the direction of flight is incorporated. The front lobe exerts most of the lifting power, while the other, which is considerably smaller, is jointed, and is manipulated in order to steer the vessel. This method achieves exceptional manœuvrability, and the ship is said to be capable of turning round completely in a space no wider than a city street. In addition to this, it is claimed that the arrangement makes it possible for the ship to hover indefinitely over one spot.

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Aeroplanes Purchased out of Income

Two ex-R.A.F. officers, Captain H. M. Talbot-Lehmann, M.C. and Captain F. Warren Merriam, A.F.C., have inaugurated a scheme that aims at making it possible for a man earning only about £300 to £400 per annum to own and fly an aeroplane. The cost of flying an average British light aeroplane is not considerably greater than that of running a car, and these enterprising airmen will be prepared to deliver a second-hand machine upon a deposit of 25 per cent. of the purchase price, the balance to be spread over a period of one or two years.

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Proposed Mid-Oceanic Seadrome

It has been announced by a firm of American naval architects, that work is soon to be commenced upon a floating seadrome similar to the one about which an article appeared in our January issue. The seadrome will form a stopping place for aeroplanes carrying out a service between New York and Bermuda, and will be anchored midway between these terminal points, approximately 300 miles from the nearest land.

In the construction, 6,000 tons of steel and 2,000 tons of iron will be employed, and chains four miles in length will attach the seadrome to special anchors on the sea bed. The total length of the seadrome will be 1,200 ft., and the width 200 ft., while the cost is estimated at approximately £300,000.

The Boulton and Paul "Partridge"

The Boulton and Paul "Partridge" single-seater fighting machine is one of the most up-to-date aeroplanes of the all-metal type now in regular production. The designers have not departed a great deal from conventional practice as regards general details, but they have paid much attention to the incorporation of standardised parts and have achieved a considerable degree of success in this direction.

The top wings of the machine are slightly larger than the lower ones, having a span of 35 ft. while the span of the lower wings is only 31 ft. The total wing surface area is 311.3 sq. ft., and the total length of the machine 23 ft. The weight in full flying condition is 3,097 lb. The landing speed is 61 m.p.h., and with a full load and at an altitude of 20,000 ft. a maximum speed of 164 m.p.h. can be attained. The engine is a supercharged Bristol "Jupiter" Series VII, and the weight of the engine, together with that of the fuel and oil, is 1,500 lb. The petrol supply is carried in a tank in front of the fuselage.

CIVIL AIRCRAFT MARKINGS

In the July 1928 "M.M.," we gave a list of the official registration markings for Civil Aircraft. Since that time several additions and alterations have been made, and these are summarized in the table below.

Country	Nationality Mark	Registration Mark
China	X	All combinations with C as first letter.
Denmark	J	D " "
Finland	K	S " "
Holland	P	H " "
Latvia	B	L " "
Russia	R	R " "
Austria	A	Followed by a number.
Germany	G	
Switzerland	CH	
United States	N	
Spain	M	All combinations made with any letters of the alphabet, each group containing a vowel.
Canada	CF to CK or VA to VG	Followed by three letters.

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Two airmen—one Danish and one Chinese—recently left Croydon Aerodrome in an attempt to fly to Shanghai. The machine in which they flew was one of 14 Cirrus "Avians" that have been ordered by China for the use of students of a flying school at Nanking. The total length of the journey will be 9,200 miles, and the aviators hope to cover this distance in three weeks.

The New Manchester Aerodrome

Work is rapidly proceeding with the Manchester municipal aerodrome at Chat Moss, and the Manchester Corporation Aerodrome Committee have granted provisional permission for the completed aerodrome to be made use of by a newly-formed company which is to operate under the name of Manchester Air Lines Ltd. This company has been formed to conduct local air services and also to carry intending Continental passengers to Croydon Aerodrome, where they will re-embark in another company's aeroplane. It is also proposed that during holiday times journeys should be made to popular holiday resorts such as the Isle of Man and the Lake District. Other activities to be undertaken by the Company will be repairing and rebuilding work for private owners.

At the commencement of operations the company will possess about 10 aeroplanes of the passenger-carrying type, including some triple-engined machines capable of accommodating five passengers. The cost of travelling in the company's machines is to be kept as low as possible and a charge of 1/- a mile is to be aimed at, thereby making air travel every bit as cheap as travelling by taxi-cab.

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Britain's First Aviator

Some time ago, the Royal Aero Club appointed a special committee to consider various claims to the honour of being the first British subject to accomplish a flight in a heavier-than-air machine in the British Isles. After exhaustive investigations the committee have decided that this honour belongs to Colonel J. T. C. Moore-Brabazon, M.P.

The flight by which Colonel Moore-Brabazon gained this distinction was made at Eastchurch in the Isle of Sheppey during the week-end between 30th April and 2nd May, 1909, when he flew for a distance of from a quarter to half a mile at a height of from 50 to 80 ft. While making a turn the machine crashed, but Colonel Moore-Brabazon escaped without injury.

The distinction of having made the first flight was claimed also by Mr. A. H. Phillips and Mr. A. V. Roe.

* * * *

In a memorandum issued by the Air Minister, it is stated that the airships R.100 and R.101 will most probably accomplish flights to Karachi and Montreal during the present year. Both ships are expected to be completed shortly.

The London-India Service

The first Empire air service was inaugurated by Imperial Airways on 30th March, bringing India within 6 days 5¾ hours of London.

A provisional timetable for the 5,000 miles air journey over the longest organised air route in the world has now been issued. Passengers, mails, and freight leave Croydon Aerodrome at 5-45 a.m. each Saturday and arrive at Karachi, India, at 10-30 a.m. on the following Friday.

As stated in last month's *"M.M.,"* the journey from London to India will be made by a combination of aeroplane, train, and flying boat. The section from London to Basel will be flown by large triple-engined aircraft. At Basel a transfer will be made to the night sleeping-car express to Genoa, this section being the only part of the journey made by ground transport. A fleet of new all-metal flying boats specially built for this service will operate the section from Genoa to Egypt, while the flight across the Arabian Desert to Baghdad and Basra, and on down the Persian Gulf to India, will be made in the triple-engined aeroplanes that have for the past two years been operating the Cairo-Baghdad-Basra air line with such regularity. The actual flying time between London and India will be only 52 hours.

There will be two services a week between London and Egypt, leaving London each Saturday and Wednesday, and one service weekly from London to India, leaving London each Saturday. The return flight from India to London will leave Karachi each Monday, arriving in London the following Sunday, while the service from Egypt to London will leave each Thursday and Sunday, arriving in London on Sunday and Wednesday. The services leaving Genoa on Thursday, and Alexandria on Sunday, will be carried out in conjunction with the Italian Air Company (Societa Anonima Navigazione Aerea), who will fly the sector between Italy and Egypt with Super Wal flying boats.

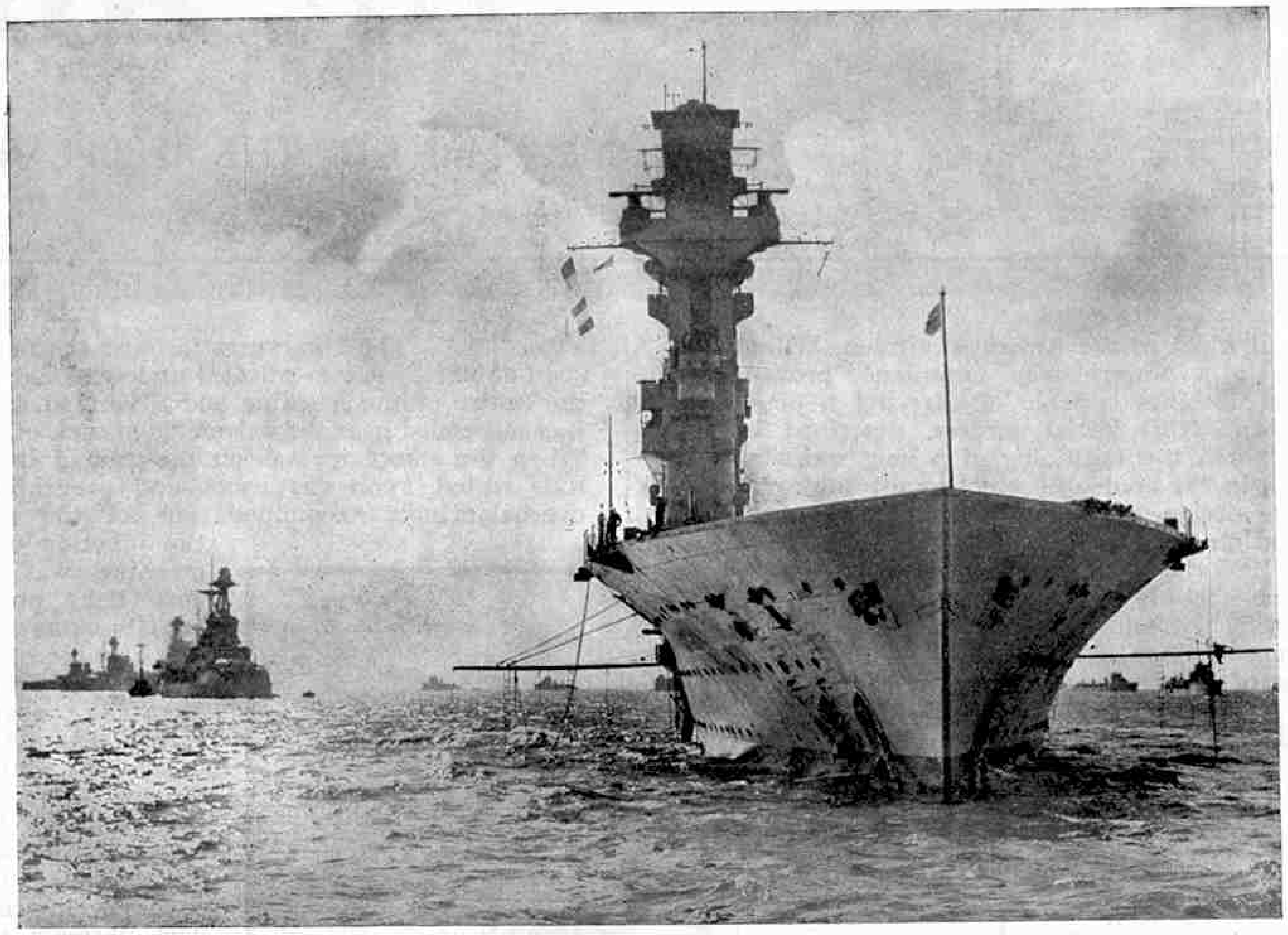
Passengers will be carried on this new Empire route, and it will also speed up mail services to Egypt, Iraq, Palestine, Ceylon, India, China, Japan, and Australia.

* * * *

In the New Year Honours list, the publication of which has been belated owing to the King's illness, the name of Mr. A. V. Roe appears among those to become Knights Bachelor. This honour has been awarded for distinguished services to British aviation.

U.S. Aircraft Carriers to be Scrapped

The Naval Department of the United States have decided to scrap the two aircraft carriers *"Lexington"* and *"Saratoga."* These two carriers have been in use for less than two years and they are the largest, fastest, and most expensive vessels of this type in the world. Their displacement is 33,000 tons and their armament consists of eight 8-inch guns, while the turbo-electric machinery with which each is equipped is capable of developing 180,000 s.h.p. The maximum speed attainable is 34 knots and the cost of the construction of each vessel was approximately £9,000,000.



A bow view of the *"Hermes,"* one of our aircraft-carriers. The superstructure and navigating pit are placed at the side so as to give space for launching and landing aeroplanes. (From the "Wonder Book of the Navy")

There are numerous reasons for the decision that has been reached by the Naval Department, the most potent one being the enormous cost that is required to keep the ships in commission. This sum is approximately from £750,000 to £1,000,000 per year! An additional reason for their fall into disfavour is that, owing to their great size, it is only just possible for them to pass through the Panama Canal. They would also prove very vulnerable during time of war, and would require a great deal of attention if any attacks on them were to be frustrated.

THIS MONTH'S AIR STORY

Wife of cannibal chief, watching airman making a forced landing on the island: "Thank goodness! Food's coming down at last!"

These monster vessels will be withdrawn from service immediately other carriers of about 14,000 tons displacement are ready to take their place. The number of smaller aircraft carriers that will be constructed to replace them has not yet been decided.

Flying Precautions over the Irish Sea

In order to add to the safety of the pilots flying across the Irish Sea from Holyhead to Baldonnel Aerodrome, the Air Ministry have recently published some interesting instructions which every pilot is required to carry out. When a pilot wishes to leave Holyhead, he must first of all report his intention to the Holyhead Meteorological Station, and before leaving the mainland for the journey across the sea he must circle the station. Observers note the time that the machine commences its journey and send a wireless message to Baldonnel Aerodrome giving the authorities there this time, together with the direction taken by the pilot.

If after some time there is no trace of the aeroplane having reached Ireland, messages are relayed to Seaforth Wireless Station, the Holyhead Meteorological Station and the Transport and Marine branch of the Department of Industry and Commerce, Dublin. All shipping in the vicinity is notified by the Seaforth Station that the aeroplane is missing and is requested to keep a look out for it. The first duty of pilots who reach Ireland safely is to communicate with Holyhead in order to satisfy the authorities that the crossing has been accomplished without mishap. Machines flying from Ireland to Holyhead carry out these instructions in the reverse order.

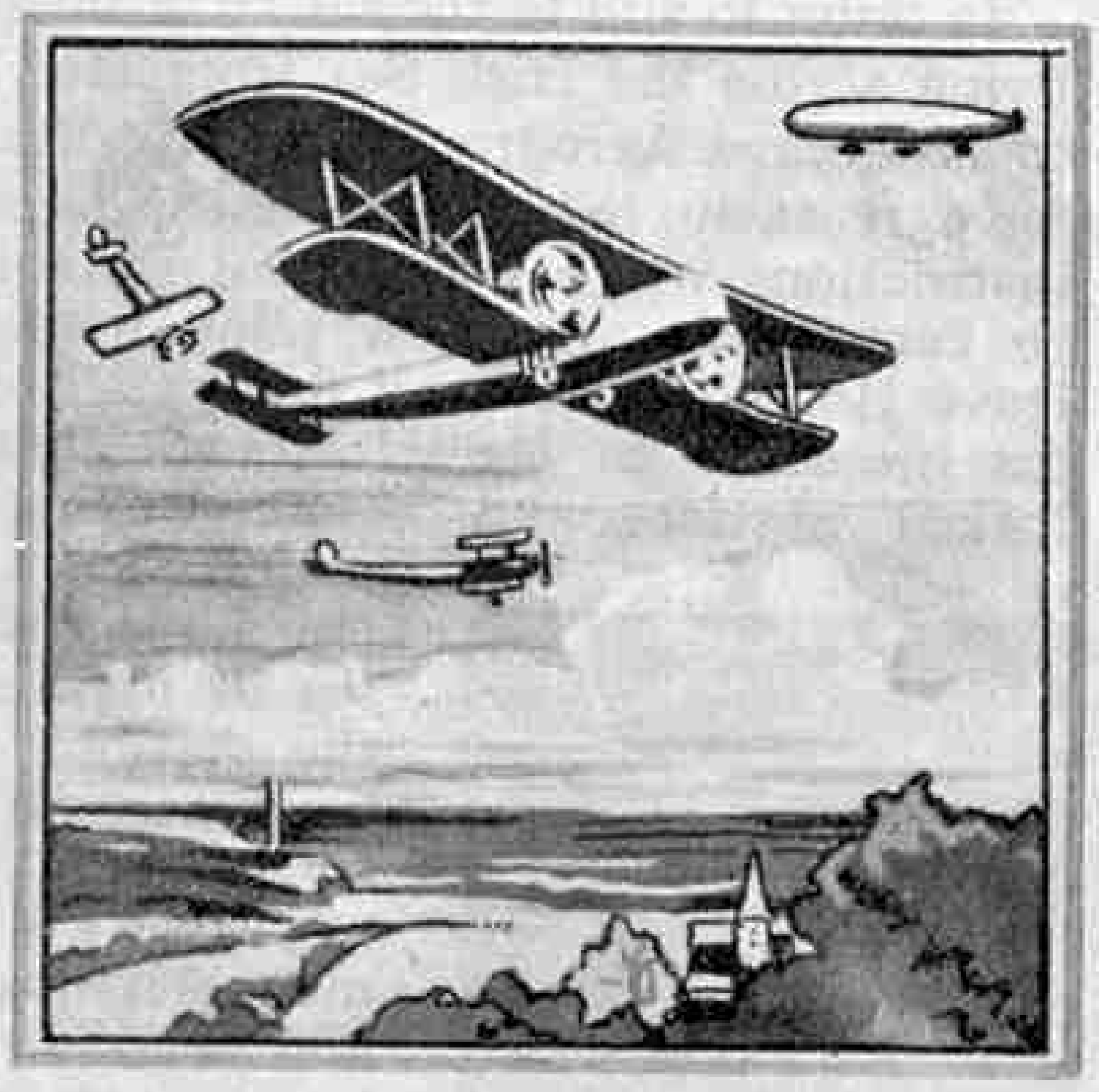
* * * *

This Year's Schneider Contest

It is expected that Britain's team in this year's Schneider Trophy Contest will consist of Squadron-Leader A. H. Orlebar, A.F.C.; Flight Lieutenant D'Arcy Grieg; Flight Lieutenant Stainforth and Flying Officer D. F. W. Atcherley. The flight will most probably be led by Squadron-Leader Orlebar.

The four machines to be used in the event are now under construction, two being built at the Supermarine Aviation works and two at the Gloster Aircraft works. Although strictest secrecy is being maintained as regards the construction and design of the machines, it is rumoured that the Gloster Aircraft Company, who have favoured seaplanes of the biplane type in past years, are this year constructing machines of the monoplane type.

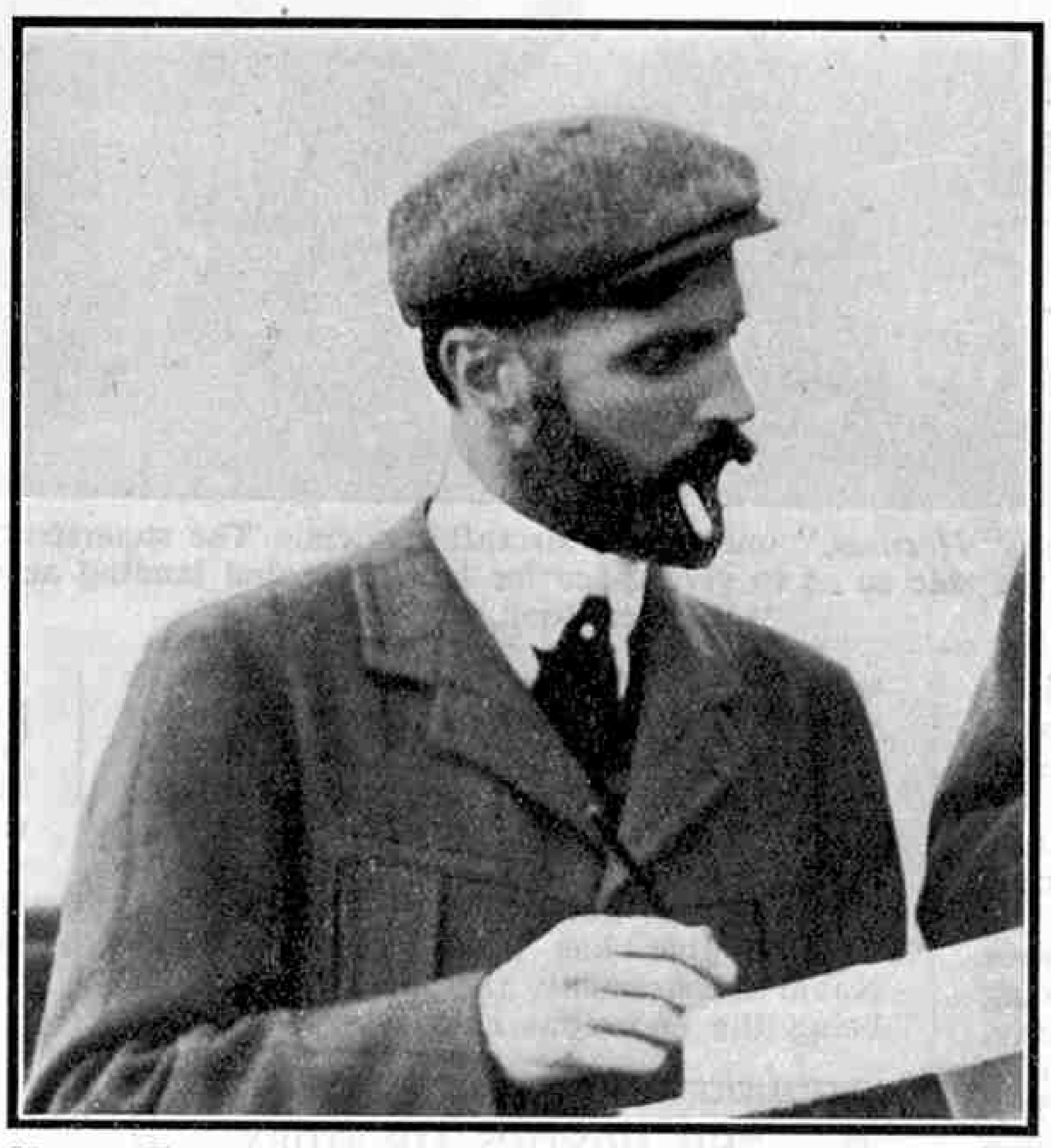
The Contest is to be flown in the first week in September, over a course in the Solent. Entries have been received from Italy, America, and France, in addition to those from Great Britain, and there will be in all 10 machines competing.



The Conquest of the Air

DEVELOPMENT OF THE AEROPLANE

THE first successful flight of the American airmen, Wilbur and Orville Wright, in a power-driven aeroplane, proved that heavier-than-air machines capable of carrying a person on board could be flown. This initial success, described in last month's "*M.M.*," marked the beginning of a long series of progressive experiments, in the course of which many improvements were effected in the design and construction of the machines. Flights of longer duration were carried out, and in October 1905 the brothers eclipsed all previous records by a successful flight lasting 30 minutes, during which time the machine covered a distance of 24½ miles.



Henry Farman, who during 1908 succeeded in flying at a speed of approximately 50 m.p.h.

These extended flights were most encouraging but they carried the airmen far from home and in so doing effectually put an end to the privacy of their experiments. The unfamiliar sight of the machine flying serenely aloft caused great excitement in the districts over which it passed, and extraordinary accounts of the airmen's doings were published in the press. The starting point of the flights became known, and vast crowds began to throng the experimental field daily in the hope of witnessing the start of a flight or at least catching a glimpse of the machine. This public curiosity was very unwelcome to the Wright brothers and, locking up the aeroplane, they suspended operations until such time as public interest in their work abated. Crowds continued to flock to the neighbourhood of the hangar, however, and eventually the airmen despaired of securing a return to their former seclusion and retired from aeronautical affairs. The newspapers grew tired of saying unkind things about them, public interest flagged, and before long the Wright brothers and their machine were forgotten.

While these events were taking place in the United States, noteworthy experiments were being carried out in France by a small number of enthusiasts, who may or may not have been inspired by the sensational reports of the achievements of the Wright brothers. Gliding machines of various types, but all bearing obvious resemblance to box kites, made their appearance, and the more enterprising investigators began to experiment on a large scale.

One of the earliest of these enthusiasts was the famous airship pioneer Santos-Dumont, who for a time turned his attention to the subject of heavier-than-air machines. He built a huge glider mounted upon two canoe-shaped floats, and carried out experiments with it on the River Seine, with the aid of a fast motor boat. The boat took the glider in tow, and when a certain speed was attained the glider slowly rose from the water and flew through the air, descending again to the water when the boat slowed down.

During 1906, Santos-Dumont constructed a curious flying machine with three box kite wings arranged in the form of the letter "T." The two wings forming the main planes had a total span of 39 ft. A two-wheeled undercarriage was attached beneath the centre of the machine and a vertical rod hooked at the base was suspended near the extremity of each of the lower main planes. When the aeroplane was on the ground the crooked ends of the rods rested upon the earth and prevented the machine from overbalancing. Accommodation for the pilot was provided at the junction of the wings. The machine was equipped with two very light propellers driven by a light but powerful petrol engine, and was capable of a speed of 30 m.p.h.

The trial flight was carried out at Bagatelle, near Paris, on 12th November, 1906. It was a very brief affair, but it greatly impressed the spectators. One account of the event relates that "the aeroplane rose gracefully and gently to a height of about 15 ft. above the earth, covering in this most remarkable dash through the air a distance of about 700 ft. in 21 seconds. It thus progressed through the atmosphere at the rate of nearly 30 miles an hour. Nothing like this has ever been accomplished before. . . . . The aeroplane has now reached the practical stage . . . "

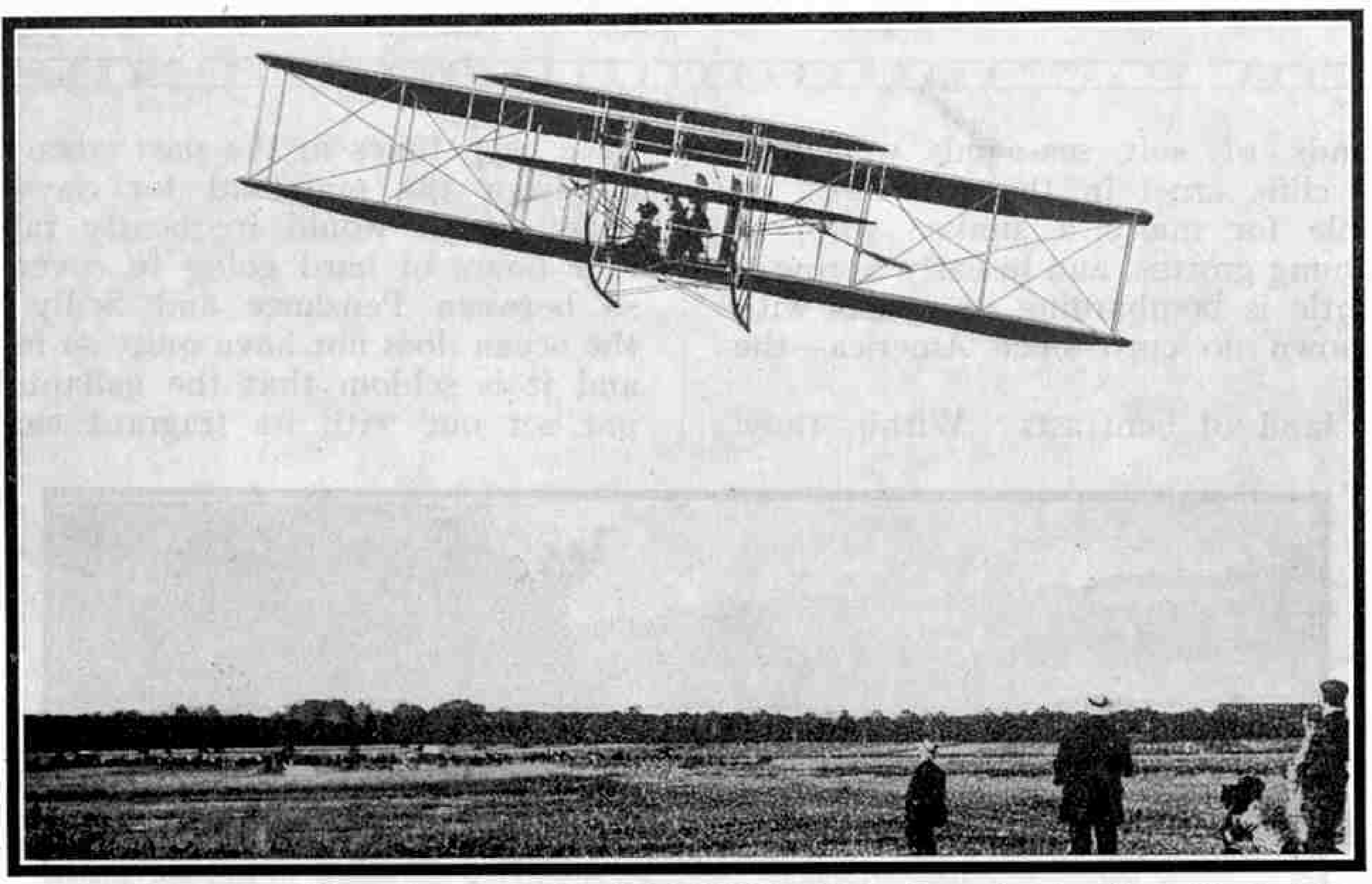
Santos-Dumont later forsook aeroplane research and reverted to the study of airship construction.

Two other noteworthy French experimenters were Charles and Gabriel Voisin. In 1904, Charles co-operated with another experimenter in building a glider equipped with floats similar to Santos-Dumont's gliding machine. Later, he became acquainted with Louis Bleriot, destined to achieve fame as the first airman to fly across the English Channel, and was engaged with him in carrying out gliding experiments in France and Switzerland.

Subsequently the Voisin brothers constructed a gliding machine of their own. It was of the biplane type, and was provided with a series of vertical partitions between the two main planes, the idea being that the partitions would increase the stability of the machine. These had the desired effect during flights in calm weather, but they were found to render the machine more liable to be blown out of its course when windy weather prevailed. The glider was tried out on 30th March, 1907, and flew a distance of 50 yards, the weather conditions being reasonably good.

In the following year they built a biplane equipped with an engine of 50 h.p. The two main planes were of almost 33 ft. span and had a total surface area of 445 sq. ft. They consisted of fabric stretched over a framework of ash ribs lying across two transverse main spars. The machine was provided with a front elevator made of double fabric covering an ash framework, while a light framework extended to the rear of the main planes and terminated in a fabric-covered tail portion. Four vertical partitions consisting of fabric stiffened by flat ribs enclosed in pockets were installed between the main planes, and others between the tail planes. A rudder that resembled the front elevator in form and construction was mounted on a vertical hinge pivoted on the rear spars of the tail planes, and was operated by wires that passed around a wooden drum on the steering spindle. The front elevator was actuated by means of a connecting rod attached to the steering wheel spindle.

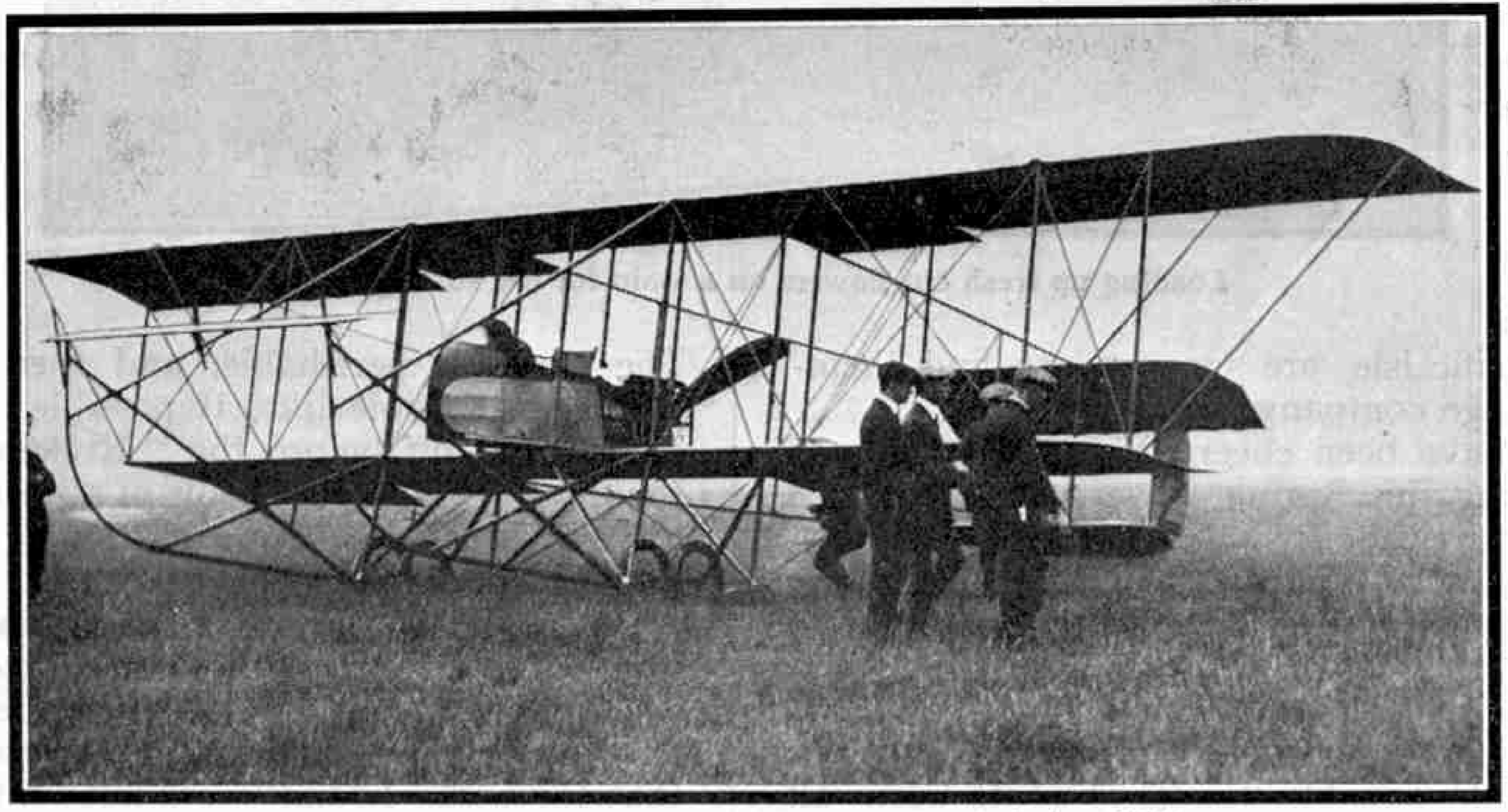
The control of the machine during flight was carried out entirely by the aid of the elevator and the rudder, the former being operated by pushing and pulling the steering wheel, and the rudder by turning the wheel upon its axis. A feature of the machine was the undercarriage, a steel tube chassis with four wheels mounted so as to swivel freely. The front wheels were provided with spring suspension to diminish the shock experienced when landing or taking-off. The Voisin brothers carried out several successful experiments with this machine, but their achievements were outclassed by the feats of other pioneer airmen of that period, one of whom was Henry Farman.



A Wright power-driven aeroplane in flight, 1909. Note the extensive launching skids that formed the undercarriage of the machine

Farman had designed a glider very similar to the Voisin brothers' first machine, but he was so impressed by the sturdy construction of the Voisin machine that he commissioned the brothers to build him a power-driven aeroplane. This machine had two small horizontal elevators in the front and a vertical rudder in the rear of the main planes. It was equipped with an eight-cylinder Antoinette petrol-driven engine capable of developing 49 h.p. at 1,100 rev. per minute. The engine drove direct a single metal screw propeller.

The machine was duly delivered to Farman and he commenced practical experiments. His first flights were in the nature of brief "hops," but gradually he became more proficient and in less than a year from commencing his experiments he succeeded in flying a distance of 800 yards. On 13th January, 1908, he created a sensation by flying in a complete circle, covering a distance of one kilometre. By this achievement he won a prize of £2,000, offered jointly by two aeronautical enthusiasts named Deutsch and Archdeacon for the first performance of this feat.



A mature Farman aeroplane constructed in 1914

In July of the same year Farman succeeded in remaining aloft in his machine for more than 20 minutes. On 6th September this achievement was exceeded by several minutes by another French airman, named Delagrange, who also flew a Voisin type of biplane. Three weeks later Farman regained the record by a flight that lasted 42 minutes, during which time he flew about 24½ miles. This rapid succession of longer flights stimulated public interest in aviation and set experts speculating on the possibilities of sustained flight over great distances by means of heavier-than-air machines.

While Farman and Delagrange were competing for honours, Wilbur Wright arrived from America to demonstrate to the French the capabilities of the Wright aeroplane. He was given a rather cool reception, for although many sensational reports of the Wright brothers' successes had reached France the stories were regarded generally as being too fantastic to be true. As a result the French public were unaware of the definite progress that had been made by the American airmen in evolving a practical power-driven flying machine.

Wright opened his campaign at Autours, near Le Mans, and on the appointed date a vast crowd gathered outside the huge wooden shed that accommodated the machine. For some unknown reason the exhibition did not take place that day, and on the following and several successive days crowds of people visited the aerodrome and vainly waited from morning until night. The public scepticism that prevailed regarding the capabilities of the Wright machine deepened to contempt as the promised display was repeatedly postponed, while the Press made very uncomplimentary suggestions to account for the delay.

Among those who waited in the hope of seeing Wright fly was the then editor of *"Popular Science,"* and in his account of the exhibition that eventually took place he writes:—"And then one day the doors of the wooden house swung open, out came Wilbur Wright . . . and out came an ungainly machine which is very familiar now, but was something to laugh at then—a huge thing of wood and canvas, of wires and bars and levers . . And the peasants laughed more than ever. This, then, was the thing they had waited weeks to see. As the machine was run into the middle of the field the peasants jeered more than ever. But Wilbur Wright cared nothing at all. He sat down in his seat and made ready. 'One!' he shouted. 'One!' jeered the crowd. 'Two!' he shouted. 'Two!' jeered the crowd. 'Three!' he shouted, and the crowd jeered no more, for Wilbur Wright was flying. He came down from the clouds never to be jeered at again, for these people, belonging to the most emotional race in the world, fell on his neck and kissed him."

The Wright aeroplane was equipped with a four-cylinder petrol motor capable of developing about 24 h.p. at approximately 1,200 r.p.m., and was connected by chain gearing to two wooden propellers each capable of rotating at approximately 450 r.p.m. The weight of the aeroplane, including fuel and pilot, was 1,100 lb. The machine was not provided with a wheeled undercarriage as were French machines, but had two

(Continued on page 303)

The Flower Isles in Spring-time

The Romance and Fragrance of the Scilly Isles

By K. Norman Browne

SCILLY—the islands of soft sea-winds wet with spray, of great cliffs cruel in their strength, of rocks accountable for many a sunken ship, of deep caves and fern-hung grottos, and in early Spring—when the wild Atlantic is bombarding its coasts with a force that has known no curb since America—the Islands of Flowers!

Verily, here is a land of contrasts. Within these islands, about the coasts of which still linger dark tales of smugglers and wreckers, storms and shipwrecks, are to be found acres and fields of flowers that from February to April are gay with scent and colour. Here is a field of sheer gold "daffies" gleaming in the Spring sun, there one of white narcissi, swaying in the sea-breeze and filling it with their heavy scent. There are yellow jonquils, here mauve tulips, while in sheltered corners palms, cacti, aloes, bamboos, vegetation of some exotic Pacific isle, are surprised to find themselves in such strange company.

Loading up fresh cut flowers on a wain for the sorting house

Few of us who have been cheered to see daffodils at street corners during this Spring, have realised whence many of them came. Scilly—the British Holland—is, thanks perhaps to the uncertainty of the crossing, as remote to-day as when, a century ago, its inhabitants, far removed from the patrol of coastguards, earned a fat living from their ill-gotten plunder.

It is in early February, sometimes in late January—for Scilly enjoys the equable climate of South Cornwall to an even more marked degree—that the flower fields begin to yield their harvests. The fields are mostly enclosed with hedges of veronica, escallonia, or tamarisk perhaps. The season, as it continues, is an anxious one for the grower, for although the climate of the Scillies, with its absence of frost, is very kind, nevertheless there is always the fear that some great wind may wreck whole fields of blossoms, in spite of their protecting hedges.

There is, too, the question of shipping the flowers to Penzance *en route* for their various markets. The Atlantic cannot be trusted in this respect, and there have been times in the past when Scilly has been cut off from the mainland for days together. Twenty years ago it would frequently take a small steamer four hours of hard going to cover the forty miles or so between Penzance and Scilly. To-day, however, the ocean does not have quite so much of its own way, and it is seldom that the gallant little steamer does not set out with its fragrant cargo.

Each evening sees much bustle on the quay at St. Mary's. Great care has to be taken with the packing to ensure that the flowers will arrive in a fresh condition. Motor boats from Tresco, St. Martin's, St. Agnes, and Bryher, the smaller islands, come cutting through the water. Early next morning, if fortune is kind, the steamer starts for Penzance. Once here, further bustle begins. Frequently some forty tons of flowers have to be dealt with and dispatched to various widely-scattered markets. The cargo is perishable, and there can be no delay. Those responsible like, if possible, to have most of it loaded and off before the "Riviera" express occupies the line. It is to the credit of all concerned that flowers leaving Scilly early one morning, can be sold in the London markets on the next.

Scilly was a land of romance long before its associations with golden daffies and sweet-smelling narcissi. The Islands have their stories and legends as interesting as those of any other remote region. It is supposed that the Scilly Islands were known to the Greeks as the Cassiterides or Tin Islands, and to the Romans as the Sillinae. Whether the Phœnicians came this way in search of tin is a matter for conjecture. In later days, we read of the gallant defence of the Islands by a band of Cavaliers who only surrendered to Blake in 1651.

The most interesting tradition of all is that concerning the lost country of Lyonnesse. If there is any truth in the old story, a land rich and fertile, of which the Islands were the high regions, once united them to the mainland. Beneath the sea to-day, they say, are great forests and the churches of one hundred and forty parishes. Here, says legend, is that vanished land where knights fought for their ladies, and where :—

> "All day long the noise of battle roll'd
> Among the mountains by the winter sea ;
> Until King Arthur's table, man by man,
> Had fallen in Lyonnesse about their Lord."

And the sea which has separated Scilly from the mainland, has furnished most of her history. There is an old church on St. Mary's where, resting among the exotic plants of a more tropical island, lie the victims of many a wreck tossed upon the shore.

Sorting and tying flowers in bunches ready for the market

It is a silent witness that the island which can produce flowers can equally well furnish tragedy. Here is a grim story, half legend, half history, with which to conclude. It happened in the year 1707. A British fleet, under Sir Cloudsley Shovel, was returning from the siege of Toulon. Harassed by a series of storms, the fleet made towards Scilly. Legend has it that a sailor on board the flag-ship was a native of the Islands, and declared that the course held must inevitably bring her on the rocks of Scilly. He was tried for inciting mutiny, and hanged at the yard-arm, only a few hours before his warning came true. Three of the ships perished, and two thousand men. Sir Cloudsley's body was thrown ashore, at a point, according to tradition, called Porth Hellick, or the Cove of Willows, where still, say the old folks, no grass will grow. The Admiral's body was stripped and buried by the fishermen. Subsequently it was removed and re-buried in Westminster Abbey.

Grim stories of long ago! A lighthouse now warns sailors of the dangers they run, and the Islands of shipwrecks have become the Islands of Flowers. Nearly forty years ago, Sir Walter Besant, describing Samson, one of the smaller islands, wrote :—"I shall never again behold a daffodil in February, without thinking of Samson. You have lent a new association to the Spring flowers. Henceforth they will bring back this glorious view of sea and islands, grey and black rocks, the splendid sunshine and the fresh breeze."

We are indebted to the Editor of the "*Great Western Railway Magazine*" for permission to reprint this interesting article.

Transporter Bridge—*(continued from page 321)*

presses against one of the Pulleys 61 on the Rod 50, thereby throwing the $\frac{1}{2}''$ Pinion 71 out of engagement with the Contrate 73 and bringing its fellow Pinion 72 into engagement with the Contrate, thus reversing the direction of rotation of the Sprocket Wheels 52 and 53 and hence the direction of motion of the carriage. When the carriage reaches the other end of the bridge it strikes the Pulley 95 (Figs. 1 and 4) thereby actuating the reversing mechanism through the medium of the Rod 63 (Figs. 1, 3 and 4). This time the Pinion 72 is thrown out of engagement with the Contrate and Pinion 71 is brought into gear, while the Rod 49 carrying the Pulley 74 is returned to its original position, ready to meet the carriage again when the latter once more reaches the left-hand end of the bridge.

It should be noted that when the direction of the Sprocket Chain is reversed, the $1\frac{1}{2}''$ Strip 96 (Fig. 4) must travel from one Double Bent Strip 24 (Fig. 5) to the other before setting the trolley in motion. Hence the carriage pauses realistically at each end of its travel before returning.

Conquest of the Air—*(continued from page 301)*

launching skids ; these necessitated the use of a launching platform.

On 21st September, 1908, Wright beat all previous records by flying for 1 hr. 31 min. 25 sec., during which period he travelled 56 miles through the air. On 31st December he added further to his laurels by accomplishing a flight that lasted two hours.

These various successes, following closely upon one another, helped to make the year 1908 one of the most progressive and interesting in the history of aeronautics.

While Wilbur Wright was giving demonstrations in France his brother Orville was carrying out test flights at Fort Meyer, U.S.A., for the American Government, and on 9th September he made three notable flights. On the third flight the machine carried a passenger in addition to the pilot, and the trip lasted 1 hr. 14 mins. On 17th September Orville Wright set out on a flight with a Lieut. Selfridge as passenger, but the machine came to grief and the trip ended in tragedy. The mishap was attributed to one of the propellers coming into contact with one of the stays of the main planes. Selfridge received such severe injuries that he died shortly afterwards, while Wright also was seriously hurt.

Silkworms—*(continued from page 305)*

together. When the thread of a cocoon has become loose, the end is located and slowly drawn up. If the water is of the right temperature the thread will unwind easily ; if it is too hot the thread will come away in masses, while if it is not warm enough the thread will repeatedly "stick." The end of the thread drawn away from the cocoon is then secured to the drum of some simple reeling machine, by turning which the rest of the cocoon is unravelled and the thread is coiled around the reeling drum.

A simple reeling machine may be constructed as follows. Obtain four flat pieces of wood, each about 8 in. in length and $\frac{1}{4}$ in. in width, and attach them in pairs to form two crosses, the arms of which must be at right angles. The two crosses should then be fixed a few inches apart by passing through their centres a piece of stout, strong wire : which then resembles the axle of a pair of wheels. The device is now converted into a drum by fastening a number of flat, wooden strips across from wheel rim to wheel rim. One of these cross-strips should be made easily detachable so that, when the whole of the silk of one or more cocoons has been wound upon the drum, the strip can be slipped out. This causes the coil of silk to slacken a little and thus enables it to be grasped and gently pulled off the drum. Two wooden uprights serve to support the drum, the axle of which passes through a hole near the top of each post. A home-made handle of some sort is secured to one of the projecting ends of the axle and everything is then ready for reeling the silk.

The end of the thread drawn away from the cocoon in the basin is carefully fastened to one of the fixed cross-strips of the drum and winding is commenced. The reeling drum is rotated with one hand, while with the other the upward passing thread should be guided so that it coils evenly around the drum and does not pile up in one part. The basin should not be too near the reeling machine, otherwise the thread will be so wet when it coils around the drum that it will stick to the silk already wound.

When the completed coil of silk has been removed from the machine it should be drawn out into a loop and knotted in the middle to form a skein.

Silkworm Rearing as a Hobby

A Fascinating Pastime for the Summer Months

THE series of articles relating "*The Story of Silk*," published in the "*M.M.*" of October-December 1927, aroused great interest, and we continue to receive requests for information from readers who desire to try their hand at silkworm rearing on their own account. The purpose of this article is to meet the needs of these correspondents more fully than can be done in a letter, and to form a reliable guide to other readers who may be attracted to this interesting subject.

An ex-soldier near Berlin occupies his leisure time breeding silkworms. In the above photograph he is seen carefully collecting the cocoons spun by the silkworms

Silkworm rearing is a fascinating summer hobby and has the additional virtue of being a very cheap one, for although silkworms feed voraciously, their food is of an inexpensive kind. A minimum amount of apparatus is required, and while patience and careful attention are very necessary, these are factors essential to the success of any intelligent hobby.

The first step is to acquire some silkworm eggs, and these should be purchased in April or early May. A sufficient quantity to meet the requirements of the amateur silkworm rearer can be obtained for a few pence from various dealers in naturalists' requisites (see advertisement on page 351). When received from the dealer the eggs will be observed to be almost circular in shape, somewhat flat and of a greenish-grey or a slate-grey colour, according to breed. They are very minute, as may be gauged from the fact that 10,000 of them weigh ¼ oz.!

The eggs should be placed in a clean box containing a supply of mulberry leaves, or if these are not obtainable lettuce leaves are a fairly good substitute. The box need not be of any particular kind or shape, but perhaps the most suitable is a rectangular wooden box about 18 in. in length, 9 in. in width and 6 in. in depth. The lid should be removed and cut away until it forms a frame or slide into which a piece of plain glass can be inserted. When the glass has been fitted into place, the lid should be refastened to the box. This type of lid enables the activities and development of the eggs, and subsequently of the caterpillars to be observed without disturbing them. In order to ensure sufficient ventilation, a hole should be cut at each end of the box, and covered with a small piece of gauze or perforated zinc.

After spinning cocoons the silkworms change to chrysalides, a group of which is shown above

The box should be kept in a moderately warm and well-aired room, in a position where it is out of the way of draughts. If the only convenient position that can be found for it is near the window, where the direct rays of sunlight will fall upon it, the box should have its original wooden lid and not a glass one. The main point to be aimed at is to protect the eggs as far as possible from extremes of temperature, and there is little difficulty in doing this if a little care is taken.

The eggs hatch during May in from five to eight days after the commencement of incubation, the exact period varying with the warmth of the weather. As the time for hatching approaches, the eggs change to a light colour, and the protecting shell of each one becomes so nearly transparent that the outline of the caterpillar curled up inside can be faintly seen. A brownish coloured mark on the shell denotes its position, while a tiny dark spot shows the position of the head.

The actual hatching of a silkworm egg is interesting, and is well worth watching. With the aid of a good magnifying glass the caterpillar can be seen extricating itself from its shell, and the observer will notice that the caterpillar breaks through at the rounded side of the shell, and not through the flat surface as might be expected. The tiny creature that emerges from the shell is barely 1/12th of an inch in length, and is too small for its various characteristics to be seen by the naked eye.

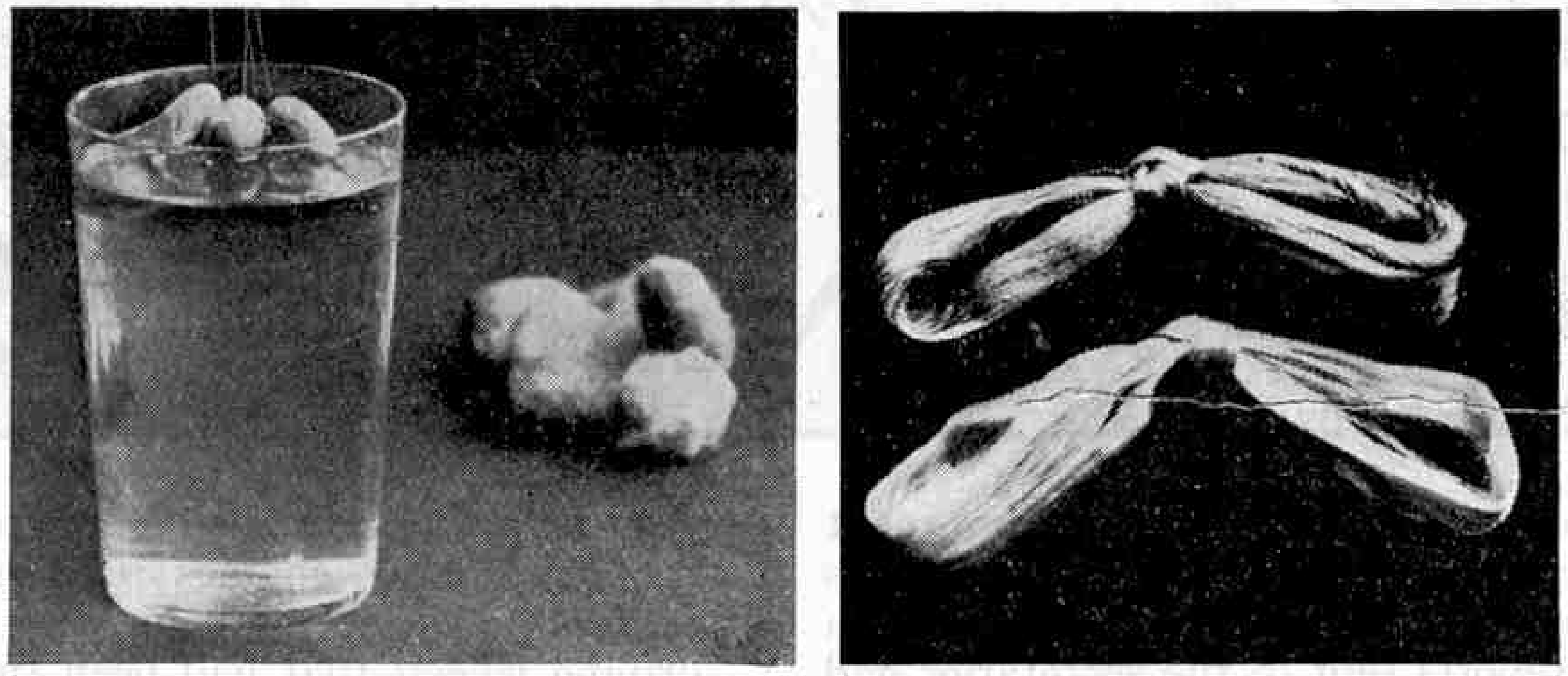
The majority of the eggs will hatch within a short period of each other. It is very important that the silkworms should all develop simultaneously and perform their moults at the same time. The few that hatch a day or so in advance of the rest should be allowed to perish, therefore, and any that have not hatched by the fourth day after the first caterpillar has appeared should be thrown away also as they will yield only feeble, inferior insects, which, by moulting at different times from the majority, will have to be kept entirely separate.

Soon after birth a baby silkworm commences to eat ravenously and continues to do so for five or six days when, its skin having become uncomfortably tight, it loses its appetite and stops feeding. This pause is known as the end of the "first age." Before recommencing to eat the caterpillar casts off its skin and reveals a second one ready grown underneath. This interesting manœuvre was described in detail in the "*M.M.*" for November 1927.

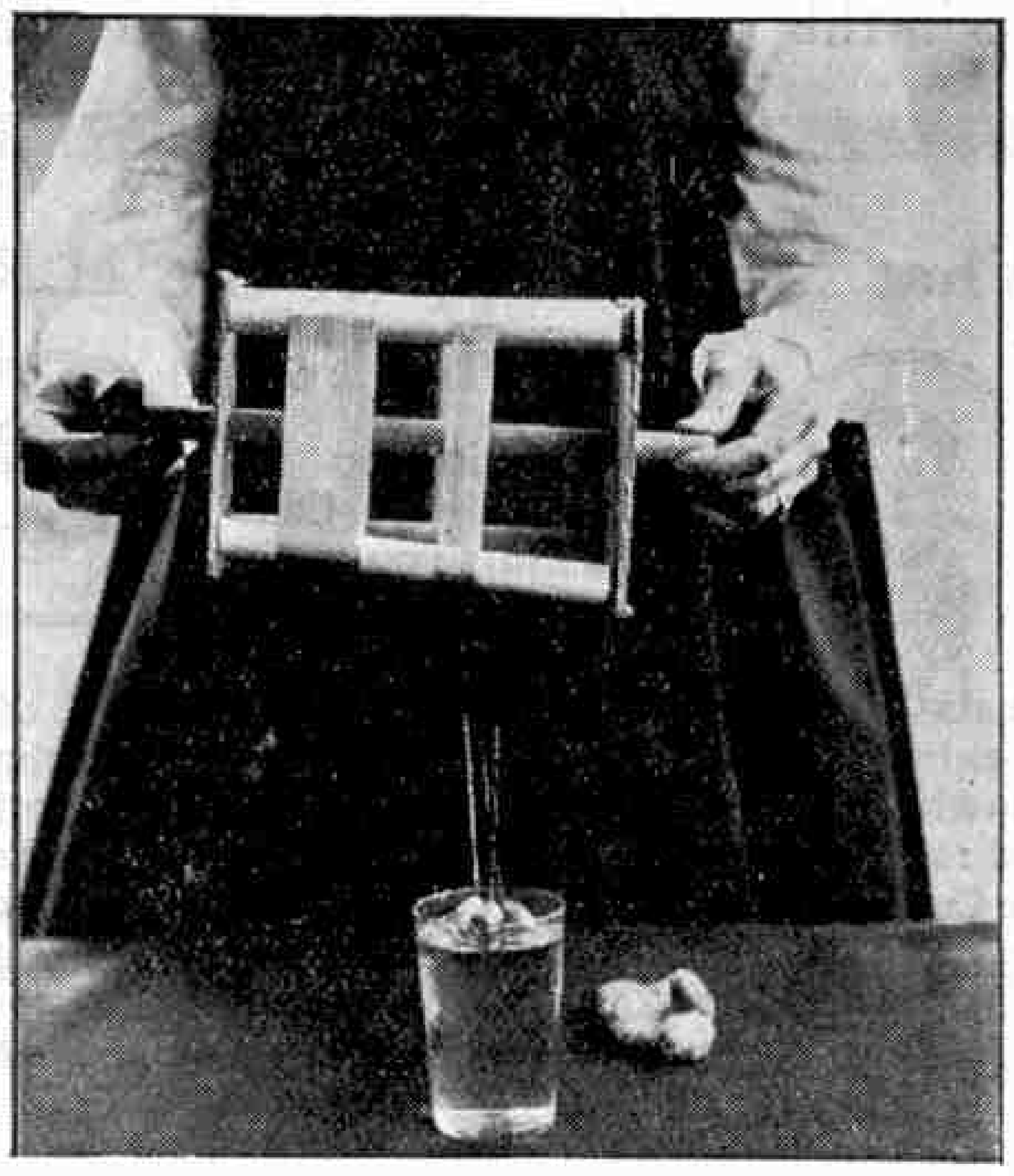
The natural and proper food for silkworms is, of course, mulberry leaves. If this favoured food cannot be obtained, however, lettuce leaves are about the best substitute, but it is necessary to remove all moisture from these leaves before placing them in the box, as otherwise they are injurious to the health of the silkworms. The varieties of cabbage lettuce are considered to be the best for the purpose.

During the first week the caterpillars should be fed three or four times daily with small quantities of young and tender leaves. The leaves should be cut up into narrow strips, as they then provide more edges for the little creatures to attack, for this is where they begin munching, holding the leaf between their legs. During the second, third and fourth "ages," each of approximately five days' duration, the silkworms increase steadily in size and pale a good deal in colour. Their appetite increases also after each moult, and from the beginning of the second week they should be fed five or six times daily with fresh leaves. The rule to be observed in feeding silkworms is "little and often," for while on no account must there be any stinting of food, too much at a time should not be given to them, as leaves soon become shrivelled and stale and in this decaying condition they are unfit for food.

It is very important that the silkworms' modest home be kept clean, and cleaning should be done a day or two at the most after each moult. The simplest method is to place over the caterpillars a net, or a sheet of finely perforated paper, on top of which fresh leaves are placed. In a short time the caterpillars will find their way up through the mesh or perforations, and the net or sheet can be then gently lifted out of the box while the latter is cleaned up.


(Left). Commencing to unwind cocoons. (Right). Coils of silk that have been removed from the reeling machine and knotted into skeins

During the first seven or eight days of their fifth "age" the silkworms eat more food than during the whole of their preceding existence, and extra care must be taken at this time to see that they are fed plentifully with the richest mulberry or lettuce leaves. The nourishment in the food is now being expended more in building up within the creatures the elements of silk than in continued growth of the caterpillars themselves. If the amateur silkworm rearer is unable to keep the caterpillars supplied with fresh leaves at frequent and regular intervals during this important period he should endeavour to get someone to carry out this simple task on his behalf.


An excellent illustration of a simple reeling device for unravelling silkworm cocoons and coiling the delicate thread around a drum

About the eighth day the appetite of the silkworms begins to diminish, and a day or so later they cease feeding. Their skin loses its soft bloom and begins to look shrunken, and so wax-like as to be almost transparent. Each silkworm now becomes very restless and, forsaking the mulberry or lettuce leaf, it trails disconsolately about, endeavouring to climb any favourable object it encounters. It continually lifts its head, moving it sideways, backwards and forwards, seemingly shaking itself and appearing giddy. Thin wisps of silk-like thread begin to issue from "spinnerets" in its lower lip. These peculiar actions indicate that the caterpillars are seeking a place wherein to spin their cocoons, and a few twigs should now be placed over the leaves in the box. The silkworms will speedily discover these twigs and, climbing up, will soon find a suitable place for spinning.

The observant amateur will notice that a silkworm first casts a few threads from one supporting twig to another to reduce the instability of the structure to a minimum. This "first" silk is thin and irregular, and is used only as a support for the home that the silkworm next spins. Beginning at the farthest point, and gradually working towards its central situation until there is left only sufficient threadless space for it to turn round in, the caterpillar spins an elaborate lattice work of delicate threads. At the end of one day's spinning this outer covering, showing in the rough the ultimate oval shape of the cocoon, is completed.

Male and Female Silkworm Moths

The silk that is spun is secreted in two separate vessels in the silkworm's body, and it appears through two small mouths situated just beneath the jaws and quite close to each other. The two threads thus emitted are united into one immediately by a kind of varnish.

On completion of the outer covering the silkworm commences to spin the true cocoon, and this task occupies three days and nights. The silk so spun is of a gold or greenish white tint. As the tireless creature continues spinning it gradually becomes lost to view in the maze of threads that thicken around it. The cocoon is spun by a peculiar waving movement of the head and a slow turning of the body. Hour after hour this monotonous motion is maintained, the silk-like gummy thread winding itself, with never a break, backward and forward along the inner wall of the cocoon. The healthier and stronger a silkworm the greater is the store of thread that it has to draw upon, and a complete cocoon may contain as much as 13,000 yd. of unbroken double thread. At the end of the period of spinning the silkworm as such ceases to exist, and only a chrysalis is left in the centre of the silk.

The cocoons should not be interfered with for at least a week after spinning has commenced, in order to ensure that the caterpillars will have changed to the hard chrysalis state. About the eighth day, therefore, the cocoons may be removed from the twigs. All imperfectly shaped or badly spun cocoons should be sorted out and destroyed, and the same fate must be meted out to any that are stained with black spots, for these indicate that the creature is dead. The sound cocoons should be fairly hard to the touch, and in fact able to withstand considerable pressure.

If it is intended to breed silkworms for the following year, an equal number of the biggest and best shaped cocoons, and small and compact-looking ones, should be picked out. The selected cocoons should then be strung on thread by the top, taking the outer cover only. They should be spaced at least an inch apart, and hung up in a fairly warm dry place. In due course, the chrysalis hatched in each cocoon changes into a moth. About eight or nine days after the completion of the cocoon the moth tears its way out through the silk, severing all the threads in the process, and rendering the cocoon useless as a source of silk. The moths are unable to fly, and rest weakly upon the broken cocoons.

The female moth is easily distinguished, as it is very much larger than the male. An equal number of male and female moths should be transferred gently and carefully by means of a camel-hair brush from the cocoons on which they are found to a cardboard box lined with a sheet of strong white writing paper. This box should be about 8 in. in length, 6 in. in width and from 1 to 1½ in. in depth. It is not necessary to provide a lid, as the moths will not escape. The box should be placed in a warm shaded place.

The moths do not require any food, and they should be left undisturbed. The female moths generally each lay an average of from 300 to 350 eggs, and when laying is completed all the moths should be destroyed. The eggs should then be exposed to the air for a day or two, and packed away until the Spring in a cardboard box, which should be stored in a cool and absolutely dry place. If the place is not sufficiently cool, the development of the eggs will not be properly retarded during the winter months.

Having hung up the breeding cocoons in readiness for the birth of the moths, the amateur rearer should now devote his attention to unwinding all the silk of the remaining sound cocoons.

The cocoons are first placed in a basin of warm water and gently moved about in order to soften the "varnish" binding the threads

(*Continued on page 303*)

NEWS *from* H.R.C. BRANCHES

The Hornby Railway Company Branches have spent a busy month, and according to reports the programmes have been of a very varied and interesting nature. In several of the Branch reports sent in the secretaries had a confession to make—during the spell of frost the members had cancelled their indoor meetings and taken the opportunity of skating and sledging! I rather imagine that these secretaries had an uneasy suspicion that I should be very cross with them. So far from this, however, I think they did perfectly right, and Mr. Hornby agrees with me. Such opportunities for healthy winter sport are so few and far between in this country that it is foolish to neglect them, even on Branch nights!

A notable feature of the month has been the activity of Branch secretaries in making arrangements for outings to various places of railway interest, and many of the reports contain accounts of visits to locomotive sheds and to goods yards and stations. One of the fullest of these reports came from the secretary of the Ellesmere Branch, Mr. Norman R. Rice. This gives an account of the visit of the Branch to Old Oak Common locomotive running sheds (serving Paddington Station, G.W.R.), and is so interesting that I reproduce it here :—

What Membership of the H.R.C. Means to You

Your election to the Hornby Railway Company admits you to the greatest organisation of miniature railway enthusiasts in the world. The sole object of the Hornby Railway Company is to increase mechanical knowledge in general and the knowledge of railways and railway practice in particular. The members of the Company are a body of intelligent and progressive boys and men, who profit greatly from the delightful fun they have and the valuable experience they gain, in running their miniature railways on the lines of real railway practice.

" We arrived at the Old Oak shed just before three o'clock. The shed foreman, who was to show us round, was not free the moment we arrived, as we were one or two minutes before our time; and so we waited in the central office and looked around us.

" The shed is almost square, and is a combination of " round-houses." There are three electrically operated turntables with about ten " roads " running from each table. The atmosphere in the shed is astonishingly clean, owing to the excellent ventilation.

" Then our conductor arrived and we went first on to the foot-plate of " *King William IV* " (No. 6002), but owing to the fact that it was rather smoky here, and in addition, that we were hindering the " fire lighter " who was lighting the fire at the time (there were eight of us all told), we adjourned to a " cold " locomotive, " *King Henry VIII* " (No. 6013). Here we saw the usual cab fittings, the various uses of which were all explained to us in detail, and we examined the operation of the regulator, the reversing gear, water gauges, etc.

" Next, we saw the repair shops, where a new 35-ton electric crane was being erected. The shop did not contain many engines undergoing repairs (G.W.R. engines do not need repairs often), but we did see a pair of driving wheels that had been turned down, so that 1 ft. 7 in. instead of 1 ft. 5½ in. of the flange touched the rails.

" Then we went back to the " Kings " and went inside the fire-box of " *King George IV* " (No. 6003), looked into the smoke-box, made a tour of inspection of the frames, and last, but of course, not least, went down below and saw the " works " from underneath for the first time in our lives. Each road has a pit between the rails, so that the under part of any engine is easily accessible wherever it is in the shed.

" We were then shown where to wash our hands—by this time these had become *very* dirty, as can be imagined—after which we went outside to see the coaling stage and the dust destructor. We saw the famous " *King George V* " (No. 6000) at the coaling stage —she had just come off the up " Limited." We were very surprised to learn that the dust destructor saves on an average 28 tons of coal per week, which is used to heat the water used for boiler-washing. Four thousand gallons per day are drawn from the canal for this purpose. On our way out we noticed one of the new " Halls " that had just arrived. Thus ended the very interesting visit of the Ellesmere Branch of the H.R.C. to Old Oak Common."

By way of a change from the usual practice at the meetings of one Branch, the Chairman gave the members and their friends a very interesting lecture on " Aeroplanes." The theory of the streamlining and stability of the machines was clearly and thoroughly explained, and the lecturer finished by giving a thrilling description of the manner in which various stunts are performed in mid-air.

As may be imagined, the Ellesmere Branch intend to make further visits to similar places of interest—they learned more about locomotives in that one afternoon than they had ever learned before.

I am publishing on the next page a further list of the Branch companies that have been incorporated since last month's list was printed. In addition, there is a large number of additional Branches in process of formation, and a supplementary list of these is given for the benefit of those living in the various neighbourhoods.

Further H.R.C. Incorporated Branches

19. Hendon—A. Needell, 1, Sunningfields Crescent, Hendon, London, N.W.4.
20. Nottingham—G. W. Brown, "Mayoniss," Dale View Road, Sneinton Hill, Nottingham.
21. Windsor County Boys' Secondary School—A. F. D'Albertanson, 40, Clarence Road, Windsor, Berks.
22. Whitgift Middle School—N. Walter, 100, Melfort Road, Thornton Heath, Surrey.
23. "Independence"—D. A. J. Harben, 31, Alexandra Road, Leicester.
24. Pixmore—G. Thomas, 131, Baldock Road, Letchworth, Herts.
25. Sutton & District—P. Thorp, Nork Way, Banstead, Surrey.
26. Gloucester—G. T. Clark, 66, Falkner Street, Gloucester.
27. "Aska" (Kingston-on-Thames)—Mr. A. Minchin, "Aska," 76, Latchmere Road, Kingston-on-Thames.
28. Brookfield (Wigton)—J. M. Lister, Friends' School, Wigton, Cumberland.

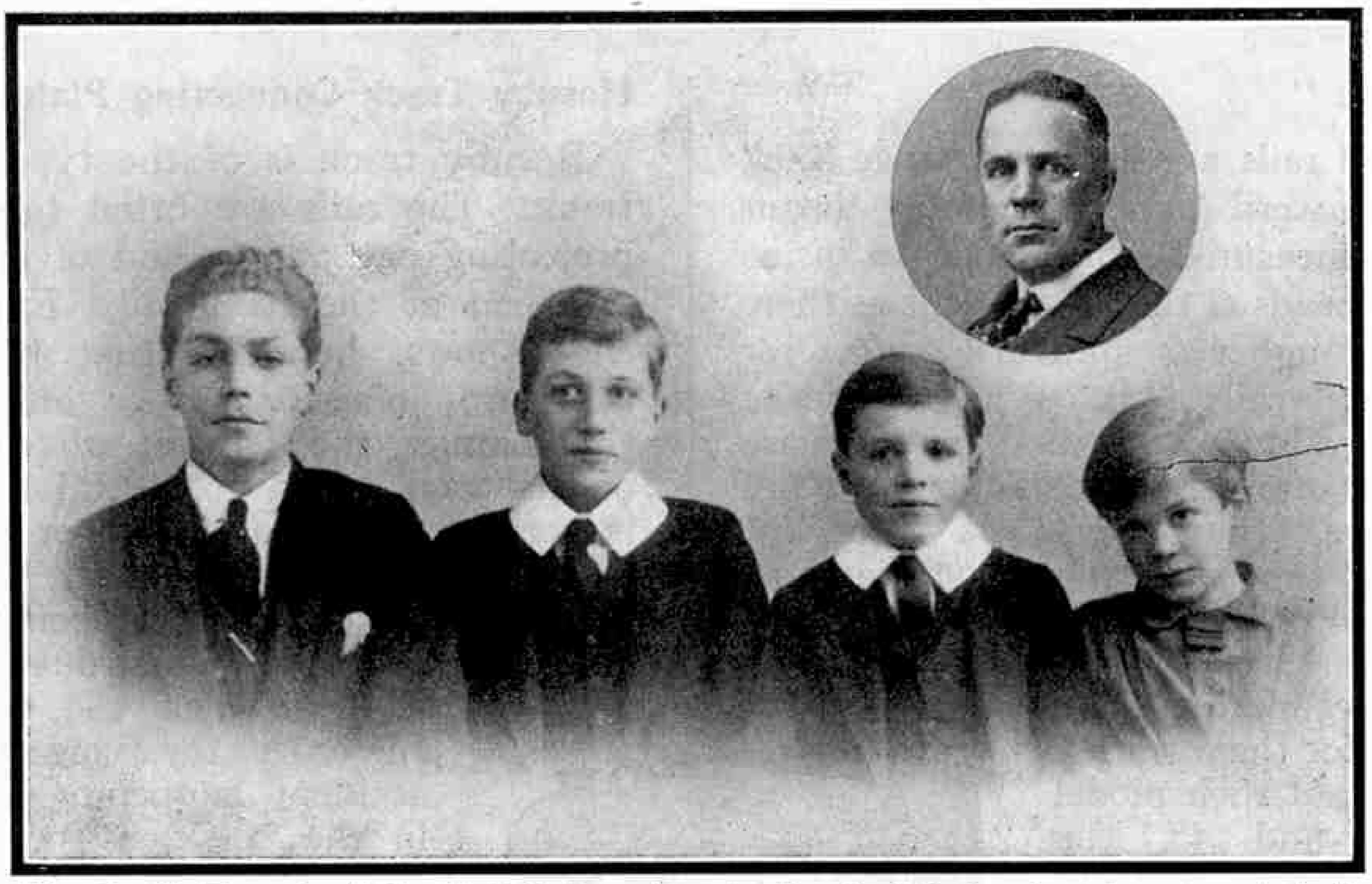
Further Branches in Course of Formation

Branches of the Hornby Railway Company are in process of formation at the following places, and those interested should communicate with the promoters whose names and addresses are given below :—

Ashington—A. D. Peggs, 17, Park Road East, Ashington, Northumberland.
Barnes, S.W.13—D. J. Higgens, 28, Hillersdon Avenue, Barnes, S.W.13.
Blackheath—P. D. Fenn, 15, Lee Park, Blackheath, London, S.E.3.
Blackpool—R. V. Bentley, 9, Barnton Avenue, Watsons Road, Blackpool.
Bolton—J. Holdbrook, 153, Longfield Road, Daubhill, Bolton.
Bowdon—W. E. Gaunt, 15, Higher Downs, Bowdon, Cheshire.
Brixton—R. Wood, 72, Bonham Road, Brixton, London.
Cambridge—H. Daniels, 3, West View, Merton Street, Newnham, Cambridge.
Clapham—D. J. Small, 22, Briarwood Road, Clapham, London, S.W.4.
Dorchester—J. Rogers, 10, High Street, Dorchester.
Essex—H. E. Paul, "Glenora," 472, Brentwood Road, Gidea Park, Essex.
Evesham—G. E. Rhodes, 1, Swan Terrace, Evesham, Worcs.
Glasgow—David Ross, 86, Hermiston Road, Shettleston, Glasgow, E.2.
Hastings—R. H. Radcliffe, 2, Trinity Street, Hastings.
Highbridge—A. C. Lewis, Lloyds Bank House, Highbridge, Somerset.
Horley—N. H. Parfitt, Westfield Cottage, Horley, Surrey.
Huddersfield—R. Porter, 85, Broomfield Road, Marsh, Huddersfield.
Huddersfield—A. F. Roper, 116, Ravensknowle Road, Dalton, Huddersfield.
Inverness—C. Smith, "Dunelm," Muirfield Road, Inverness.
Ipswich—P. Buck, 10, Dial Lane, Ipswich, Suffolk.
Kimbolton—L. G. Flanders, The School, Kimbolton, Hunts.
London, E.15—C. R. Poole, 50, Lett Road, Stratford, E.15.
Manchester—L. S. Manion, 71, Kensington Road, Chorlton-cum-Hardy, Manchester.
Mirfield—J. W. Hazzlewood, 86, Knowl Road, Mirfield, Yorks.
Northampton—B. E. Billington, 4, Vigo Crescent, Houghton Road, Northampton.
Nottingham—Mr. S. J. Burdett, A.R.C.O., 3, Burton Street, Nottingham.
Poole—J. Blackwell, "Benachie," Dorchester Road, Longfleet, Poole.
Port Glasgow—R. Liddell, "Norwood," 58, Lilybank, Port Glasgow.
Portsmouth—J. H. Bennett, 3, Hyde Park Road, Portsmouth.
Plymouth—K. A. W. Wills, 8, Birchwood Avenue, Mutley, Plymouth.
Reading—C. W. Whiteley, "Hill Top," Westwood Road, Tilehurst, Reading, Berks.
Sale—P. Risk, West Lynn, Northenden Road, Sale.
Scunthorpe—C. F. Gerard, 21, Hornsby Crescent, Scunthorpe.
St. Neots—J. W. Nicholls, "Westleigh," King's Road, St. Neots.
Thorpe Bay—M. B. Sentance, "Brooklyn," Barnstaple Road, Thorpe Bay, Essex.
Wallasey—H. Collard, 7, Birkenhead Road, Wallasey.
Witham—A. Lucking, 49, Bridge Street, Witham, Essex.
Wymondham—A. H. Williams, School House, Spooner Row, Wymondham, Norfolk.

OVERSEAS

India—P. C. Manchanda, "Ramour," 2, Mozang Road, Lahore, India.
South Africa—L. Creasey, "Elsinore," Mount Pleasant, Simonstown, S.A.



The Neath Branch of the H.R.C. is unique in the fact that, when incorporated, it was composed entirely of members of one family—Mr. and Mrs. Alexander and their sons Graham, J. W. M., Bryan and Robin. Mr. Alexander, who is, of course, Chairman of the Branch, is the Assistant Divisional Engineer at Neath, Great Western Railway. He is shown in the above photograph with his four sons.

H.R.C. Correspondence Club

The Hornby Railway Company Correspondence Club is already in a flourishing condition and its members are most enthusiastic in corresponding with their friends. It is evident, however, that large numbers of H.R.C. members have not yet realised the splendid opportunities that the Correspondence Club provides.

Membership of the Correspondence Club is open to any member of the Hornby Railway Company, without entrance fee or cost of any kind. There are only five simple rules to be observed, and these are stated in the special application form, a copy of which will be sent post free on request. In order to join the club all that is necessary is for a member to fill up this form, stating as clearly as possible his requirements.

Through the medium of the Correspondence Club members may exchange railway news and thus learn all kinds of interesting things that are taking place on railways in far-off countries that perhaps they can never hope to visit. A still more interesting feature is the exchange of photographs, either of miniature or real railways. The collection of railway photographs is a hobby with a special fascination of its own, and it is impossible to over-estimate the value of being able to exchange photographs with friends in different parts of the world—photographs which, in the ordinary way, it would be almost impossible to obtain.

It is the world-wide nature of a Correspondence Club of this character that gives it special interest and value. Railway practice varies considerably according to conditions, and there is no more pleasant way of learning how overseas railways are run than by friendly correspondence with a fellow-member of the H.R.C. The pleasure to be obtained from a comparison of model railways also must be taken into account, and those members of the club who are in correspondence with each other undoubtedly will be able to exchange useful hints and advice.

Among the many enthusiastic English members of the Correspondence Club I have four, of ages ranging from 10 to 15, who particularly wish to have correspondents in the United States. These boys are specially interested in the Boston and Albany Railroad and the New York Central Lines. Correspondents in Canada are wanted by seven or eight boys whose ages range from 11 to 19, their interest being fairly evenly divided between the C.N.R. and the C.P.R. Two boys, aged respectively 12 and 13, would like to write to friends in India, and I have one boy of 12 who is very anxious to find a South African correspondent. There is also a group of keen boys who desire correspondents in France, Germany and Italy.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

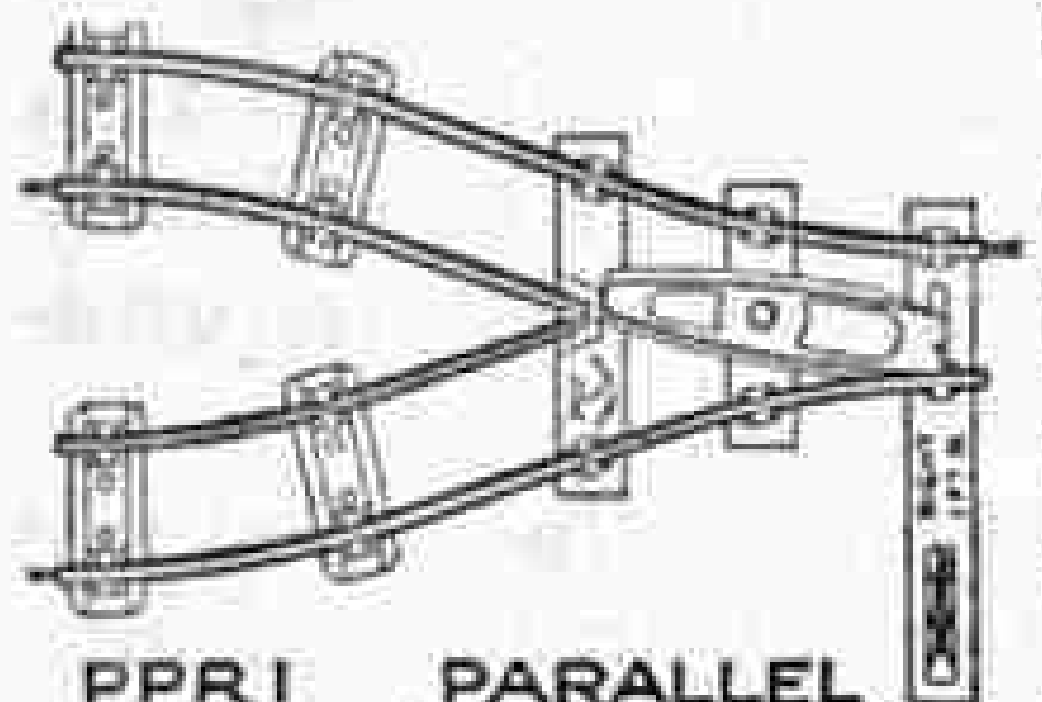
JUNIOR SECTION

IV.—Hornby Rails, Points and Crossings

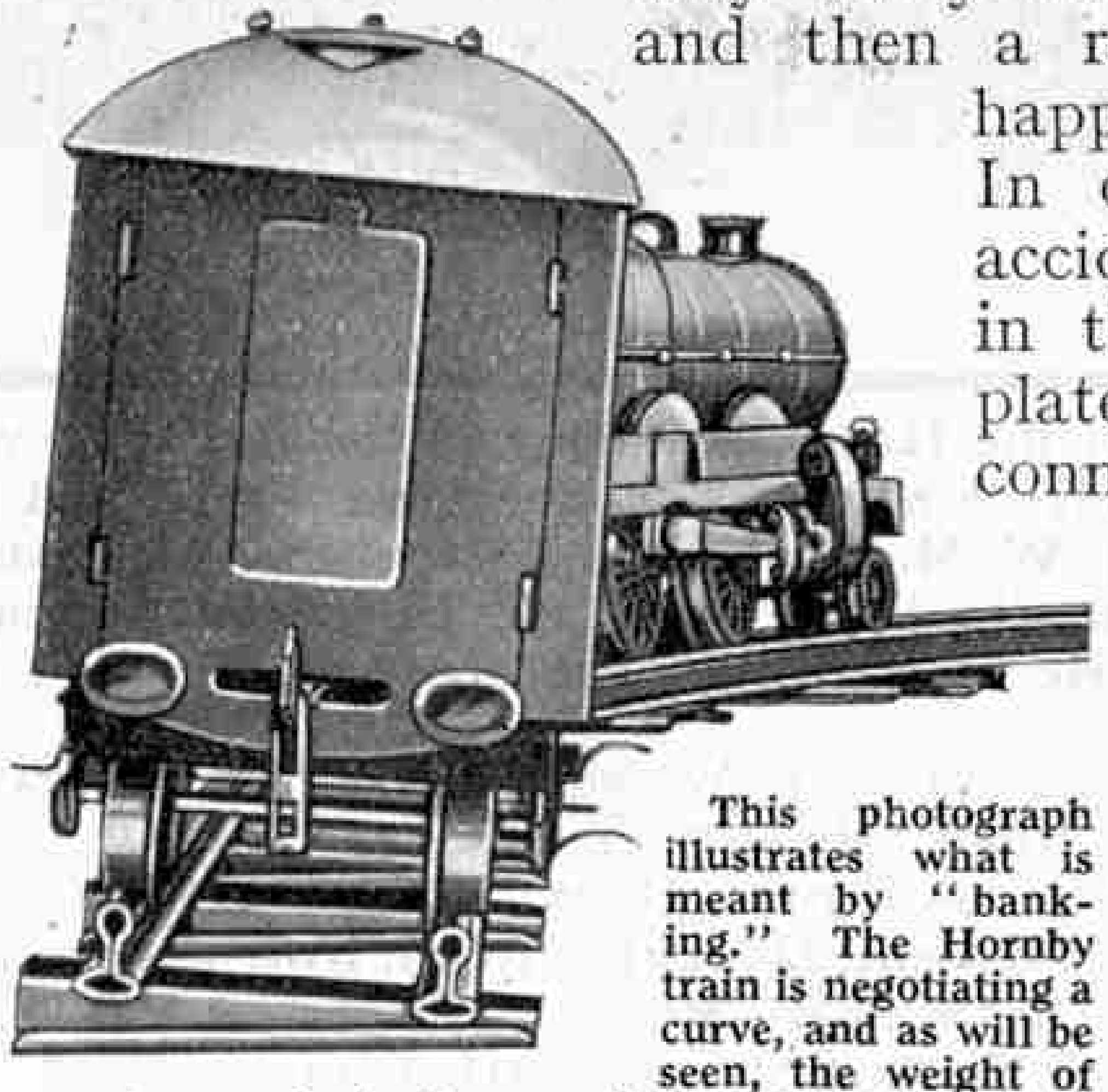
MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

The Meaning of "Gauge"

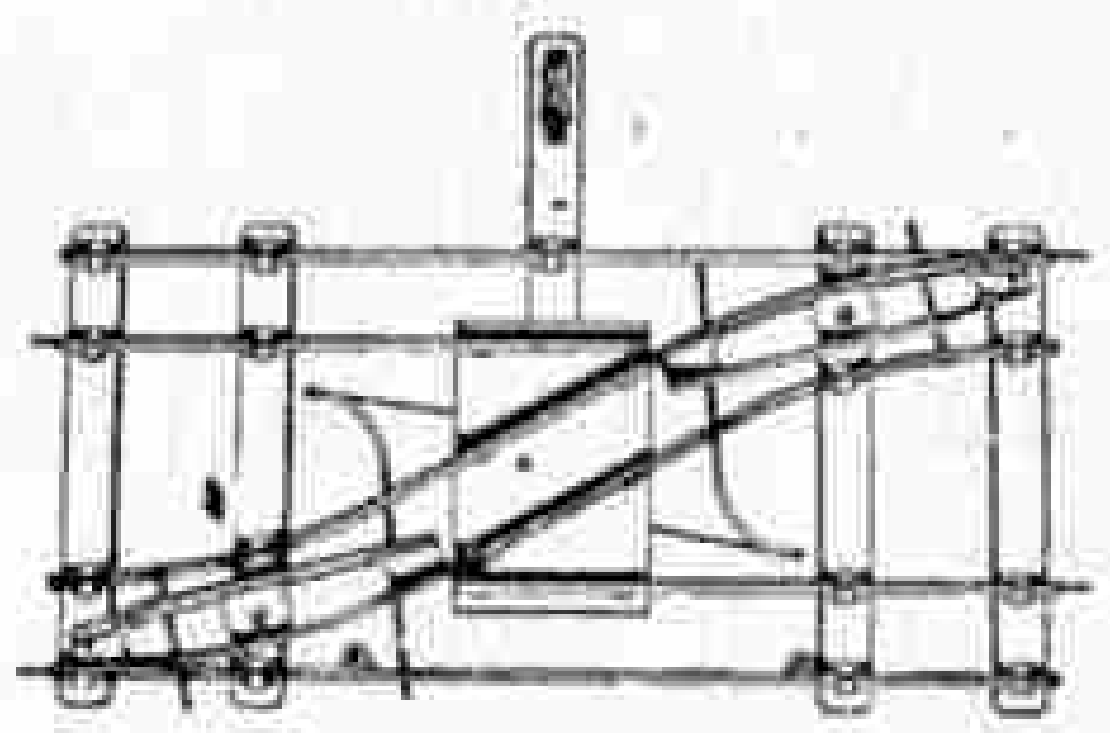
All Hornby trains and rails are built for gauge "0." In railway language the word "gauge" simply means the width of the track measured from inside to inside of the heads of the rails. Just as there are a number of standard gauges for full-sized rails (4 ft. 8½ in. being the standard in Great Britain), so there are various standard gauges for miniature railways. Gauge "0" is next but one to the smallest of the standard gauges and the width of the Hornby rail is 1¼ in.


PPR1 PARALLEL POINTS (RIGHT-HAND)

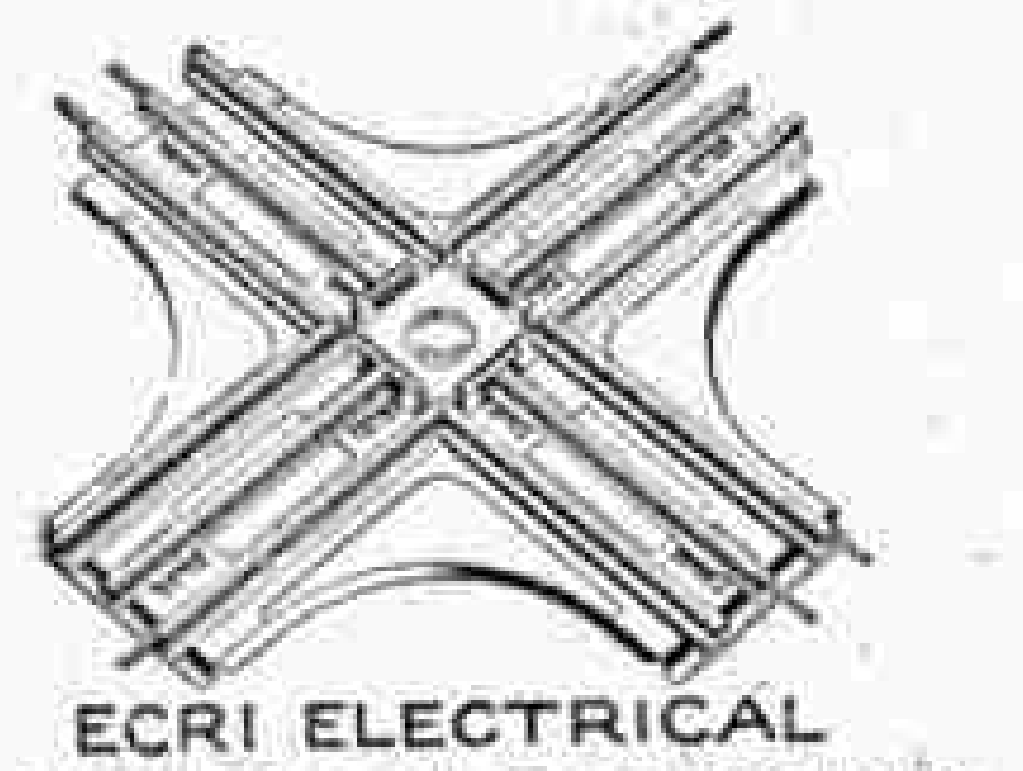
Not many boys are fortunate enough to have a room set aside for them simply for the purpose of laying out their model railways permanently, and in the majority of cases a track can only be laid down on the floor when it is required, under the condition that it is taken up and stored away tidily after use. As may easily be imagined, it is difficult, and indeed almost impossible, to give any advice of practical value in regard to the plan of a temporary layout of this nature, without first knowing the amount of material available, the size and shape of the room and, last but not least, the position of the heavy articles of furniture that cannot be moved, and which do not allow track to be laid beneath them.


This photograph illustrates what is meant by "banking." The Hornby train is negotiating a curve, and as will be seen, the weight of rolling stock is thrown slightly to one side to prevent the wheels climbing the outer rail.

Perhaps the best method is to fit together a simple oval track, and then to plan out how this can be extended and modified to fill the available space. This, of course, will result in the loss of the oval shape, but that is of no importance, provided that a good long straight run is obtained.

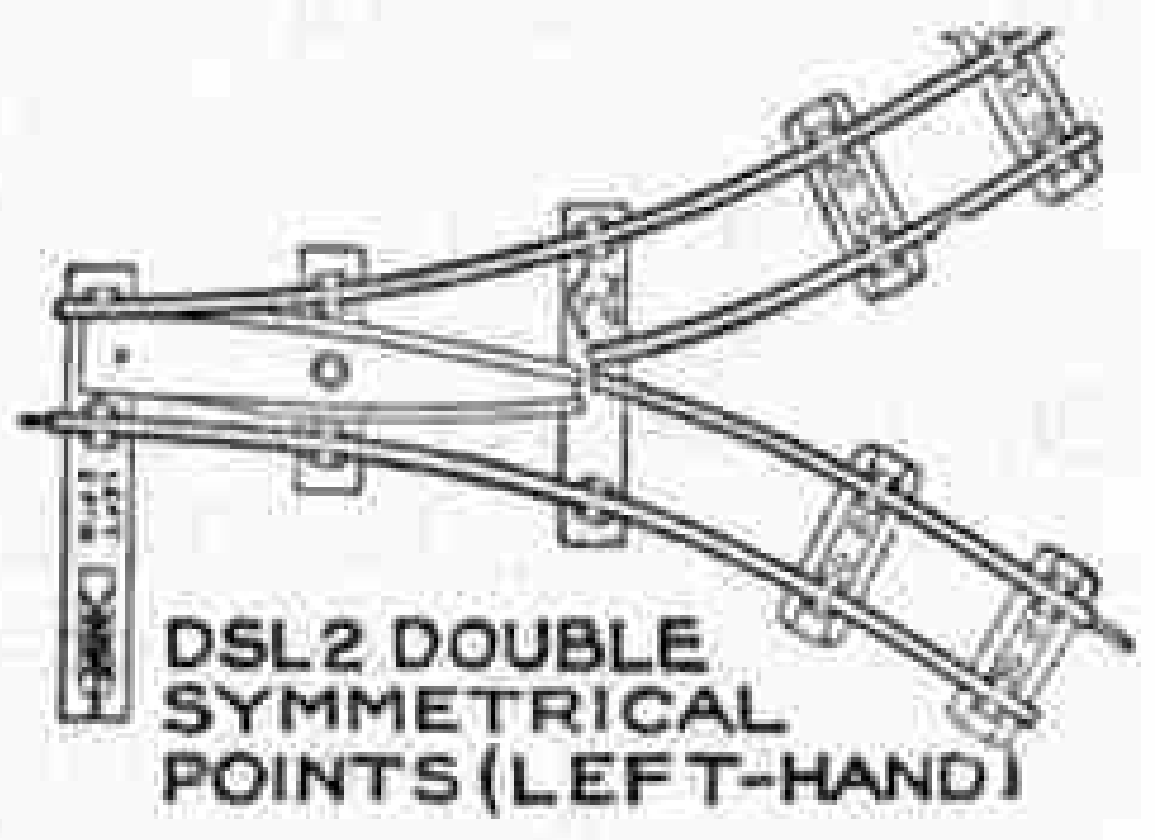

CO CROSS OVER

A great deal of fun may be obtained from a simple layout of this nature, especially if it winds in and out among the various articles of furniture. The advantage of such a track is that its simplicity enables attention to be concentrated upon the locomotives and the general smooth running of the trains. It also affords a splendid opportunity of trying the effect of the braking and reversing gear. Still another point is to note how far an engine will run on one winding. This information becomes of great importance later when branch lines and stations are being introduced, and extensive services of miniature trains are being worked to timetable, as in actual railway practice.


ECR1 ELECTRICAL RIGHT-ANGLE CROSSING

Hornby Track Connecting Plates

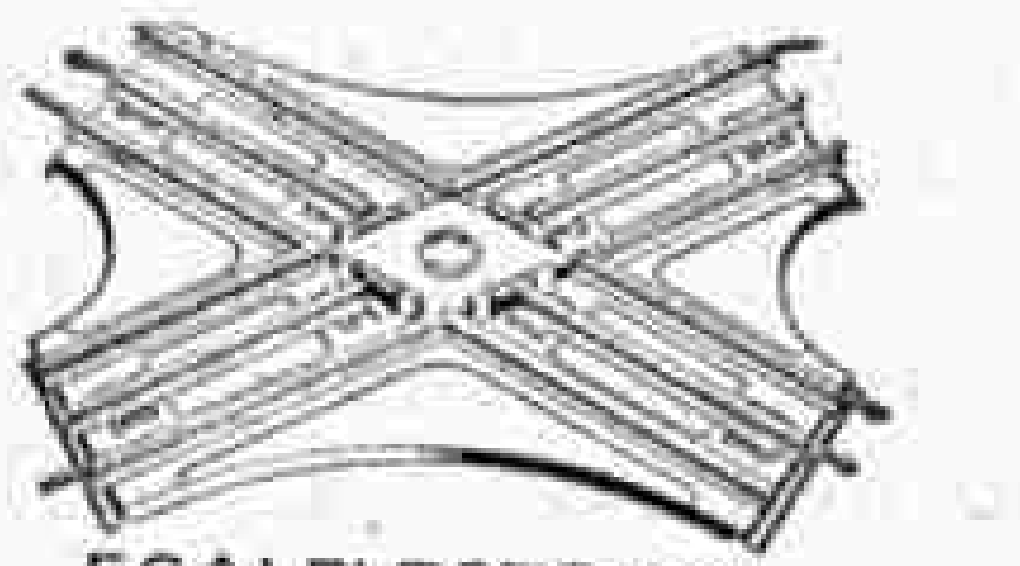
Hornby track is of the type known as "tinplate" track. The rails are fitted together by inserting the projecting peg at one end of one rail into the hollow rail-head of the next rail. Experience shows, however, that if the rails are joined together only in this manner, the slightest movement of the track or an accidental knock is very likely to cause two or more of the rails to spring apart. This may easily occur without being noticed at the time, and then a really disastrous accident is certain to happen when the train reaches the gap! In order to avoid the possibility of any accident happening as the result of breaks in the track, a special type of connecting plate has been designed. A supply of these connecting plates is provided with all Hornby Train sets and, in addition, they may be obtained separately.


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)

Another point that requires attention is the "banking" of the track. The sleepers on each Hornby rail slope upward to one side to provide the banking that is necessary to counteract the tendency of the outer wheels of a train to climb over the outer rail when a sharp curve is negotiated at high speed, and in laying down track, care should be taken to join the rails together with their sleepers all sloping in the same direction. It is not always possible to do this, but the rule should be observed in all ordinary cases.

Testing the Track

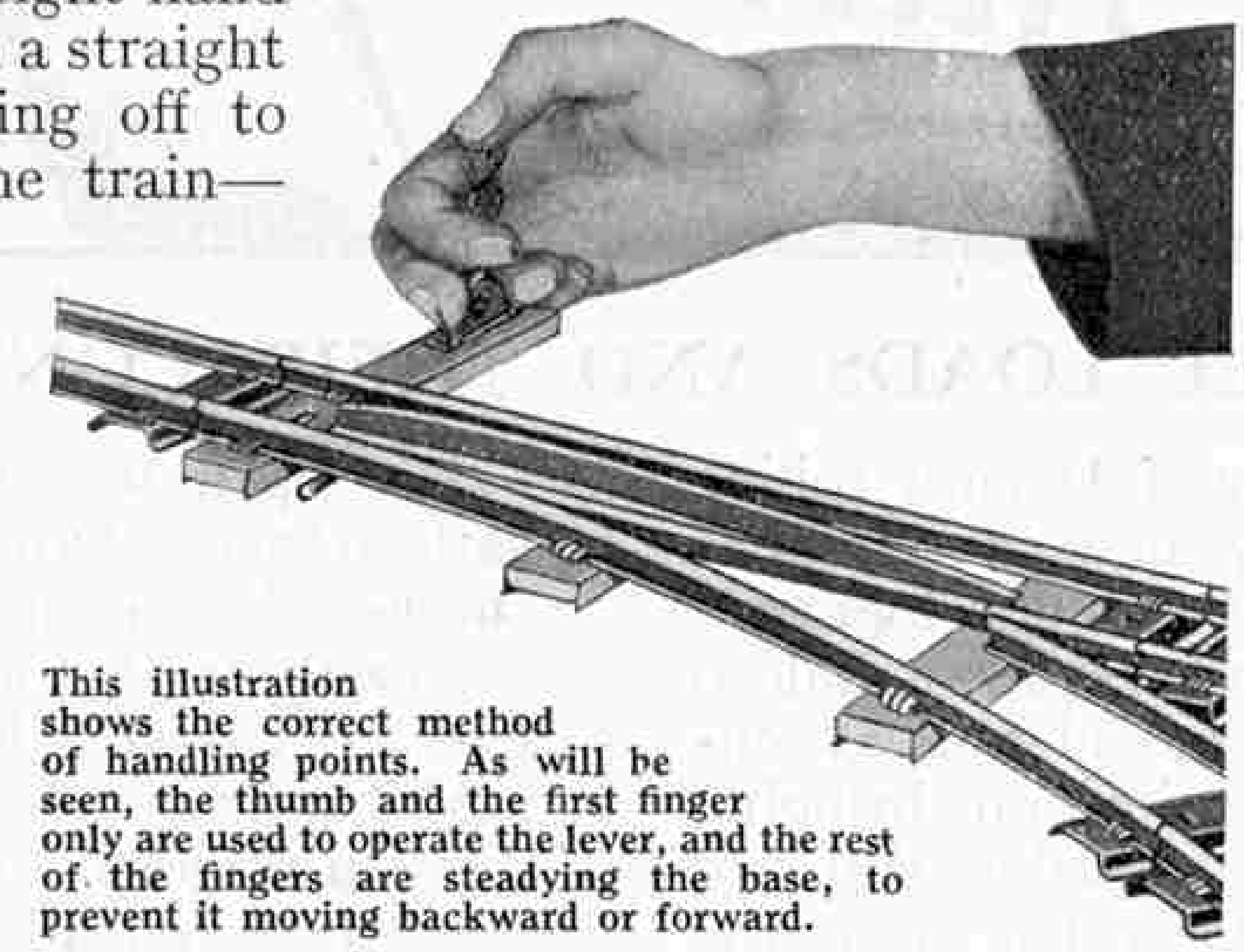
Provided that the track is laid carefully, all trains should run along perfectly smoothly, and if they do not, there must be a defective place somewhere along the track which must be searched for and put right. Very often it will be found that the trouble is due to one or more rails having become bent through rough usage. In order to simplify the finding of defective places of this kind, a very ingenious arrangement has been adopted. The top of the handle of the winding key of the Hornby locomotives is cut so as to form a perfect track testing gauge, and by sliding the key carefully along the track, as illustrated on the opposite page, defective rails may be discovered immediately.


ECA1 ELECTRICAL ACUTE-ANGLE CROSSING

An oval or modified oval may be extended to any desired length by the insertion of straight rails, but it still remains an oval. In order to introduce variety, it is necessary to make use of points and crossings. Points are employed to enable a train to be transferred from one line to another, and they consist of two movable rails called "switch tongues," placed on the inner side of the running or "stock" rails.

Points and their operation

Thus, in the case of Hornby right-hand points the train may be diverted from a straight main line to a curved line branching off to the right. The actual course of the train—that is, whether it shall continue along the main line or take the branch line, is determined by the way in which the points are set. For instance, if we wish the train to continue along the main line, points must be set straight by pulling the lever away from the straight line. The flanges of the wheels pass along the inside of the rails and therefore, on reaching the points, the left-hand wheels will continue along the "stock rail," while the right-hand wheels will pass along the right-hand switch tongue. So the points will have no effect on the train, which will continue along its original straight course.



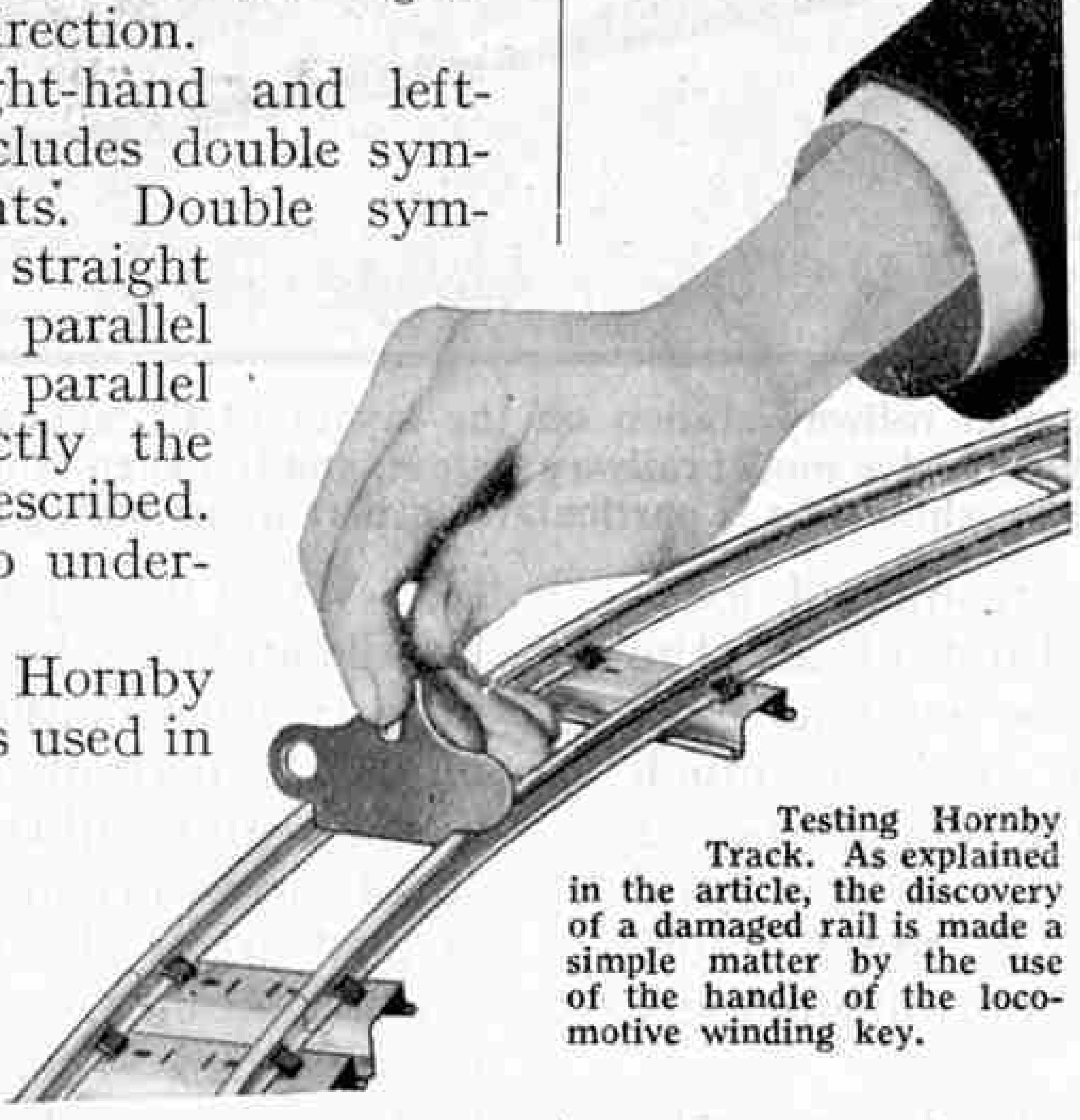
This illustration shows the correct method of handling points. As will be seen, the thumb and the first finger only are used to operate the lever, and the rest of the fingers are steadying the base, to prevent it moving backward or forward.

In order to divert the train to the branch line the position of the switch tongues must be changed, and this is effected by pushing the lever over towards the rails. In this case the right-hand wheels of the train, on arriving at the points, obviously will follow the "stock" rail, while the left-hand wheels will pass along the left-hand switch tongue, with the result that the train will be diverted to the branch line.

Diversion to a line branching away to the left of a main line is effected by means of the left-hand points working in exactly the same manner as the right-hand points, but in the opposite direction.

In addition to the ordinary right-hand and left-hand points, the Hornby system includes double symmetrical points and parallel points. Double symmetrical points are used to lead one straight line into two diverging lines, while parallel points lead one straight line into two parallel lines. These points work on exactly the same principle as the points just described, and their action is perfectly easy to understand.

The design of the points in the Hornby system is similar to that of the points used in actual railway practice, and there is little difference in principle between the two, although the latter are fitted with certain safety devices that it would be impossible and in fact useless to apply to Hornby points. One of these safety devices consists of the provision of check rails, laid inside the "stock" rails, to prevent the possibility of opposite wheel flanges mounting the rail.



Testing Hornby Track. As explained in the article, the discovery of a damaged rail is made a simple matter by the use of the handle of the locomotive winding key.

Facing and Trailing Points

There are two classes of points, known respectively as "facing points" or "trailing points," according to whether they face the direction of an oncoming train or not. Generally speaking, trailing points are used wherever possible in making crossings from main lines, on account of their comparative safety in the event of their working loose through the passage of the trains over them.

In order that a train shall pass safely over facing points, however, it is essential that the tip or "toe" of one of the switch tongues shall be against the stock rail so that the wheel flanges cannot pass between the two. Failure to set the switch tongues correctly will result in the derailment of the train, because the wheel flanges will either get between the toe of the switch tongue and the stock rail, or strike and mount the toe.

In actual railway practice, derailment would probably not follow the incorrect setting of trailing points, as the wheels of the locomotive would force the switch tongues out of the way, so making it possible for the wheels of the rest of the train to pass safely. This is not the case with Hornby points, nor tinplate points of any description, when they are placed in a trailing position. With all types of tinplate points, the entrance to the branch line is entirely closed by the switch tongue when they are set straight. For this reason, derailment will most certainly be the result of incorrect setting. There is no doubt, however, that if points are liable to work slightly loose through the passage of a train over them, they should be placed in a trailing position on a main line. There is very much less danger of accidents occurring when trains pass over loose points if these are in a trailing position.

The interest of a large layout is very greatly increased by the use of the Hornby Crossovers. These consist of two left-hand points or two right-hand points operated simultaneously by one lever. Both facing and trailing crossovers are now available suitable for use with the new Hornby Double Track.

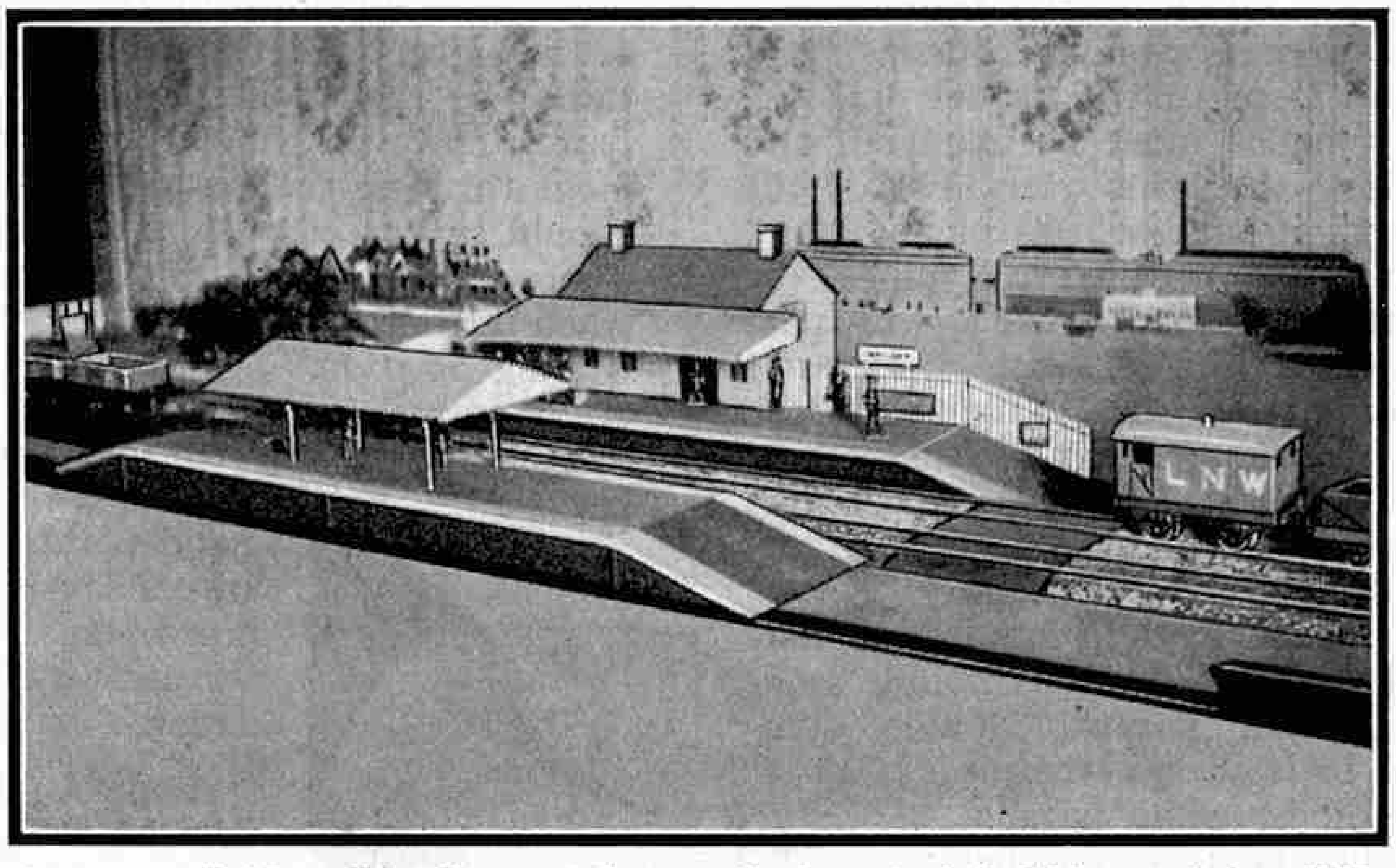
"Acute-Angle" and "Right-Angle" Crossings

Besides the various kinds of points, the Hornby System includes two types of crossings, the "Acute-Angle," or "Diamond" crossing, and the "Right-angle" crossing. These have no movable parts and are always in the correct working position.

Points and crossings in the Hornby System are made in two different sizes for layouts including curves of 1 ft. radius and those including 2 ft. radius rails respectively. If large radius rails are being used, then the use of large radius points is advisable, while the use of small radius rails calls for the use of small radius points. In buying points, therefore, it is advisable to specify the radius required. The use of the small radius points and curves with No. 2 and No. 3 locomotives invariably involves derailments, as the side-play given to the leading and trailing wheels of these locomotives is not sufficient to allow of such sharp curves being negotiated with safety.

VI.—MODEL LOADS AND THEIR CONVEYANCE

THE steady increase in the variety of Hornby rolling stock has opened up entirely new possibilities in regard to the model goods train development. The range of Hornby vans, trucks and wagons is indeed now so wide that it has led many model railway enthusiasts to concentrate their attention on bringing their goods services to the highest possible state of perfection. An even later development has been the utilising of actual model loads instead of running the wagons and vans empty. There is no doubt whatever that the interest of goods train working is enormously increased when the trains actually convey material from one station to another, and the aim of this article is to make practical suggestions as to the nature of these loads and the method of handling them. Little or no expense is involved in the preparation of model loads because, in most cases, the materials required are to be found in every household.



A very realistic model railway station on the layout of C. McLean of Ayr, N.B. McLean has a very extensive model railway system, and is a keen Hornby enthusiast. As our illustration shows, he is particularly expert in arranging scenic details

One or two important preliminary points should be borne in mind if the results of load-making are to be quite successful. First of all, the weight of the individual articles must be kept as light as possible. It is a great mistake to cram as much weight as possible into the trucks. The engine power is a fixed quantity, and a long train made up of a good variety of moderately loaded trucks is much more attractive than a short train of three or four heavily loaded trucks.

A second point of importance is that whatever the material used, it should be clean and not liable to produce dust.

As far as possible, every item of load should be made realistic in appearance. This, of course, involves a certain amount of trouble, but it is amply repaid by the final results. It is not at all railway-like for instance, to pile a number of old match-boxes on a station platform and to label them "containers," as a certain young friend of mine used to do!

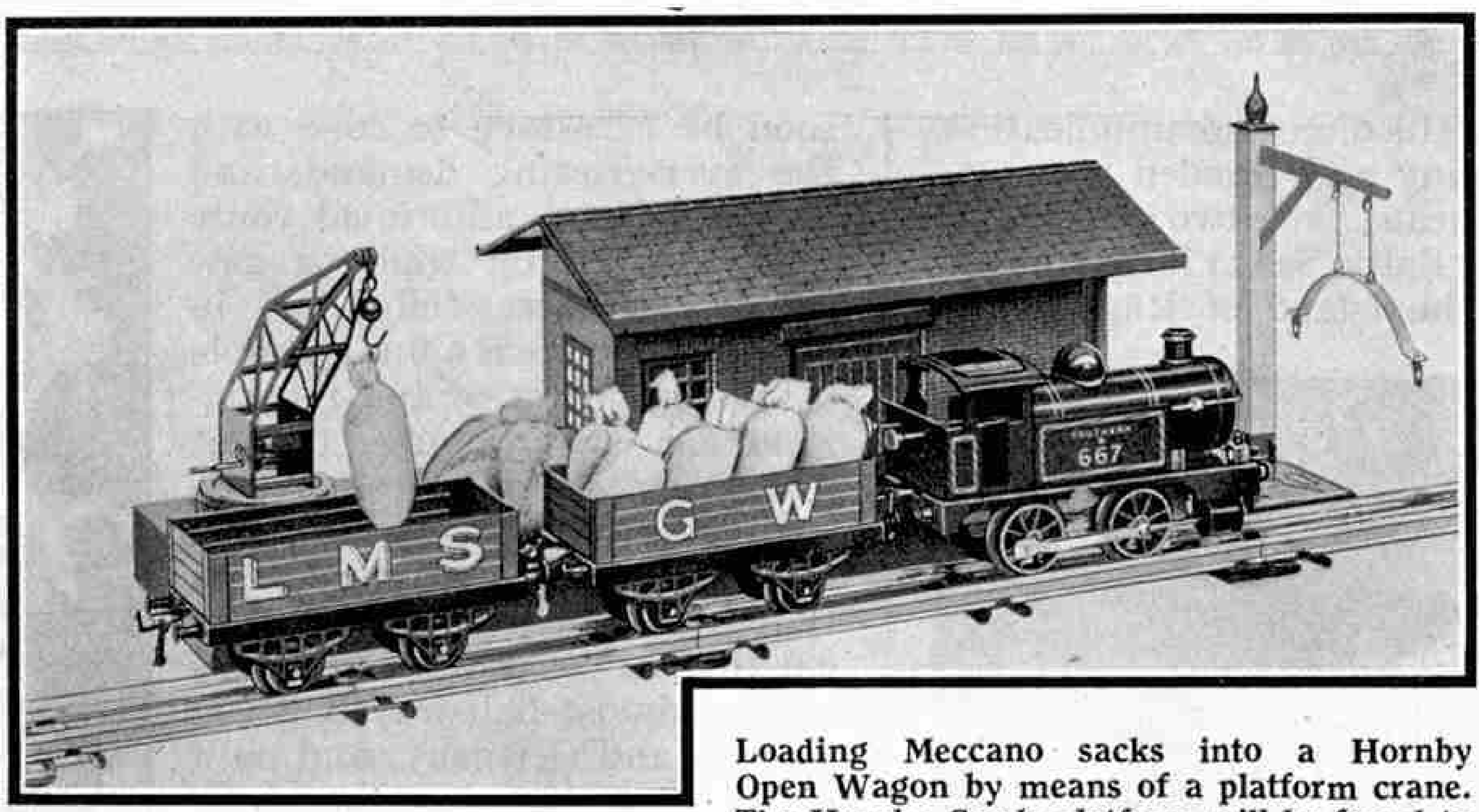
For open wagons, loads of dried peas always look satisfactory. Dried peas indeed are one of the most successful of all loads. They are easy to obtain; they are easily loaded and unloaded, and they are clean and free from dust. Rice is favoured by large numbers of model railway workers, and it certainly looks very well in open wagons. It will be found, however, that rice is not so easy to load and unload, and it is more troublesome in the case of an accidental upset.

Mineral trains may be filled with actual coal, but before this is done, certain precautions must be taken. Small pieces of coal, about the size of very small lumps of sugar, should be carefully selected one by one. When a good supply of these has been obtained, they should be placed in an old basin and thoroughly washed to free them from any traces of the coal dust that is so apt to cling to them. After this washing, the coal should be drained and then emptied on to a newspaper and left in a warm room over night to dry thoroughly. When it is quite dry, the coal will be found clean to handle and may be stacked in the goods yard of the model railway with confidence that no mess will result. Obviously a certain amount of care must be exercised in loading and unloading cargoes of coal, because if the small pieces become chipped and broken, the old trouble of dust arises all over again.

Small stones such as granite and flint chips that can be obtained from any building contractor, are very useful as cargo for goods wagons in addition to their value as ballast for the track, to which reference has been made on previous occasions. It is advisable to treat small stones or chips in the manner just described for coal.

Such loads as packing cases, barrels, crates, etc., look very well if they are placed in some definite position on a model railway station platform. It is important to remember not to place them in an untidy manner anywhere on the platform, as this will detract considerably from the realism of the station. If a realistic effect is to be obtained, goods should be placed in certain definite spots, ready for loading into vans, as in actual railway practice.

At first sight sand appears to be an ideal substance for loads, but although it is convenient in some respects, it has certain serious disadvantages. If it is to be used at all for providing loads, it should not on any account be transported loose. Sand is a very restless substance and, in spite of all precautions, it will, if loose, make its appearance where it is least desired. The effect of the smallest quantity of sand on the mechanism of a model locomotive is disastrous, and unfortunately when it has crept into any part of the mechanism, it is extremely difficult to dislodge it completely without dismantling the entire mechanism. This is, of course, a very annoying and troublesome business, and to avoid it, sand should never be used except when packed in small linen sacks. Sisters or mothers will usually oblige in this direction if approached tactfully, and will run up miniature sacks on the sewing machine in next to no time. Before it is packed into the sacks, the sand should be thoroughly dried and sieved carefully in order to remove any small stones. Care should be taken that the sacks containing sand are kept in a dry place.



Loading Meccano sacks into a Hornby Open Wagon by means of a platform crane. The Hornby Goods platform will be found to be very useful where the system handles a considerable amount of goods traffic and the shed is very handy for the storage of goods.

Very effective small bales of cotton may be made for transport in the covered vans. The best material to use for the manufacture of these, is the real thing—cotton wool! A quantity of coarse cotton wool should be obtained, and a portion of it should be separated and squeezed tightly until it forms a compact round bundle, about an inch in length and threequarters of an inch in diameter. This should then be bound round with brown linen to represent the brown packing to be seen on real bales of cotton, and the whole should then be tied round with strong yellow or brown thread. The ends of the bale should be left open so as to leave the cotton visible. It does not take very long to make a couple of dozen miniature bales of cotton in this manner, and they really are surprisingly effective when finished.

PLATFORM CRANE

RAILWAY ACCESSORIES No. 1

The Hornby Timber Wagons, No. 1 and 2 are supplied complete with a load of timber, and the No. 2 Lumber Wagon is complete with logs. Frequently, however, it is desired to make use of loads of timber for other wagons. For this purpose, timber and log loads similar to those supplied with the wagons, may be obtained separately, and they will be found very useful. In addition, portions of the smaller branches of trees may be fashioned into extremely rough lumber, and it is well worth while to lay in a stock of such lumber, cut to a convenient size. One model railway enthusiast of my acquaintance makes effective use of the sticks of matches of the large Bryant and May type, and the idea may be recommended for experiment.

Asbestos sheeting cut into small squares makes quite a good imitation of paving stones, and such squares look surprisingly realistic when stacked on end in an open wagon. Strip wood cut into small pieces is also very useful as cargo, and has the merit of being both light and perfectly clean to handle.

The interest of conveying model loads on a miniature railway may be considerably increased if some kind of system is worked to. Undoubtedly the best plan to adopt in every case is to work out some definite goods traffic timetable and to run all the goods trains strictly to schedule. By so doing, all operations will proceed at a reasonably fast pace, and at the same time the system will be worked on a real railway-like principle.

Siding accommodation is of the utmost importance to efficient working and the consequent quick handling of goods at both actual and model railway goods depots. This is an important point and should be borne in mind, especially when goods yard layouts are being planned.

It is advisable to equip all large stations with moderately roomy goods yards at the outset, and wherever possible at least two loops should be included, to enable engines, that are usually rather scarce on most model railways, to run round their trains if required, or at any rate to prevent their becoming trapped immediately on entering the yard.

If a model goods yard is really well planned, it should be quite unnecessary for a special shunting engine to be stationed at the depot. With the provision of a sufficient number of loops the train engine should almost always be in a position to effect any ordinary shunting operations unassisted, and where a goods operation timetable is being worked to it is strongly advisable to exclude shunting and banking engines from the layout entirely. These invariably cause complications to be introduced into the working of any system and are usually responsible for most time losses on schedules.

RAILWAY ACCESSORIES No. 2

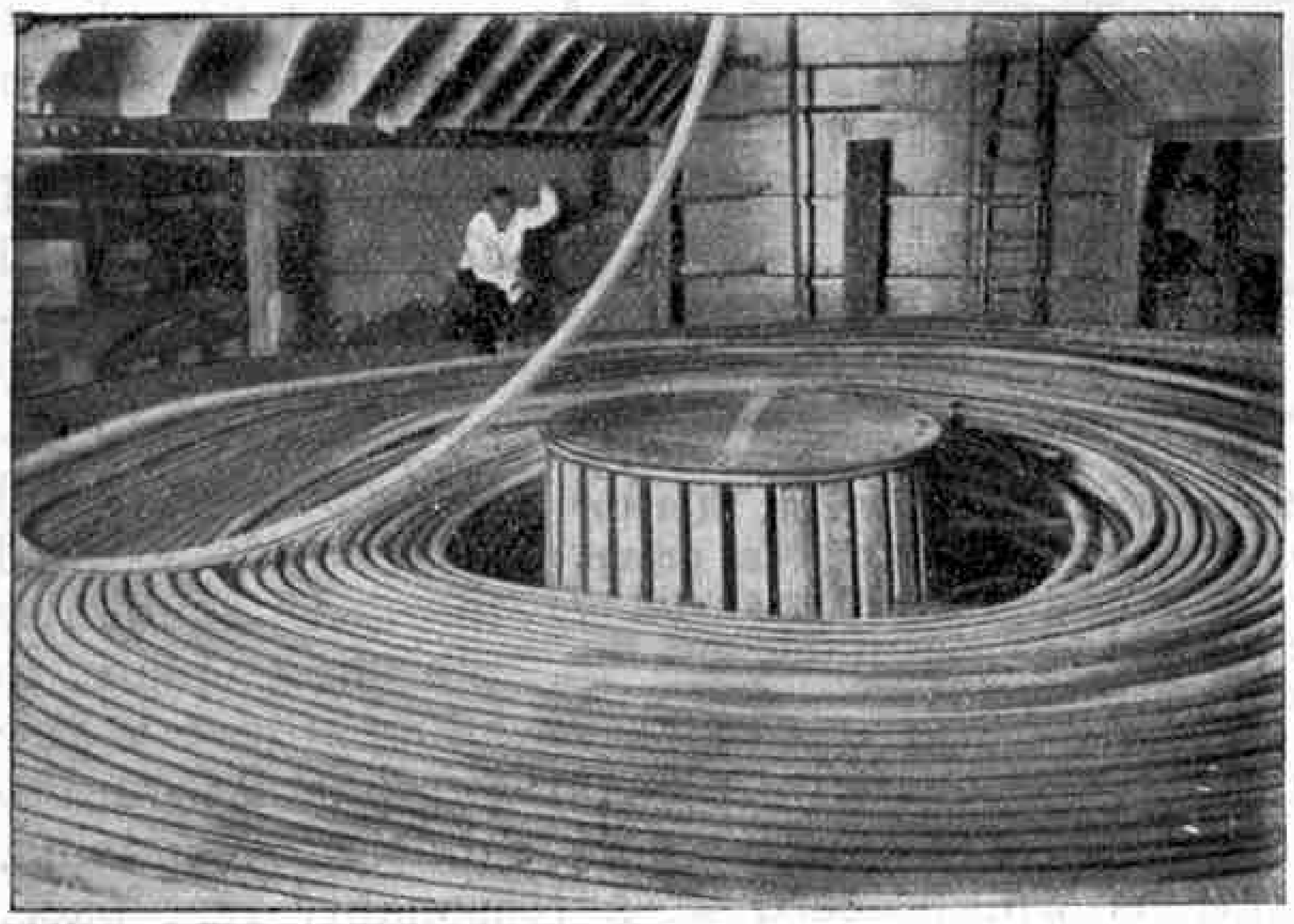
Accidents will happen, even on the best managed model railways but more often than not these are attributable to shunting engines being inadvertently left on the wrong line!

Laying a Telephone Ca

Wild Weather in S

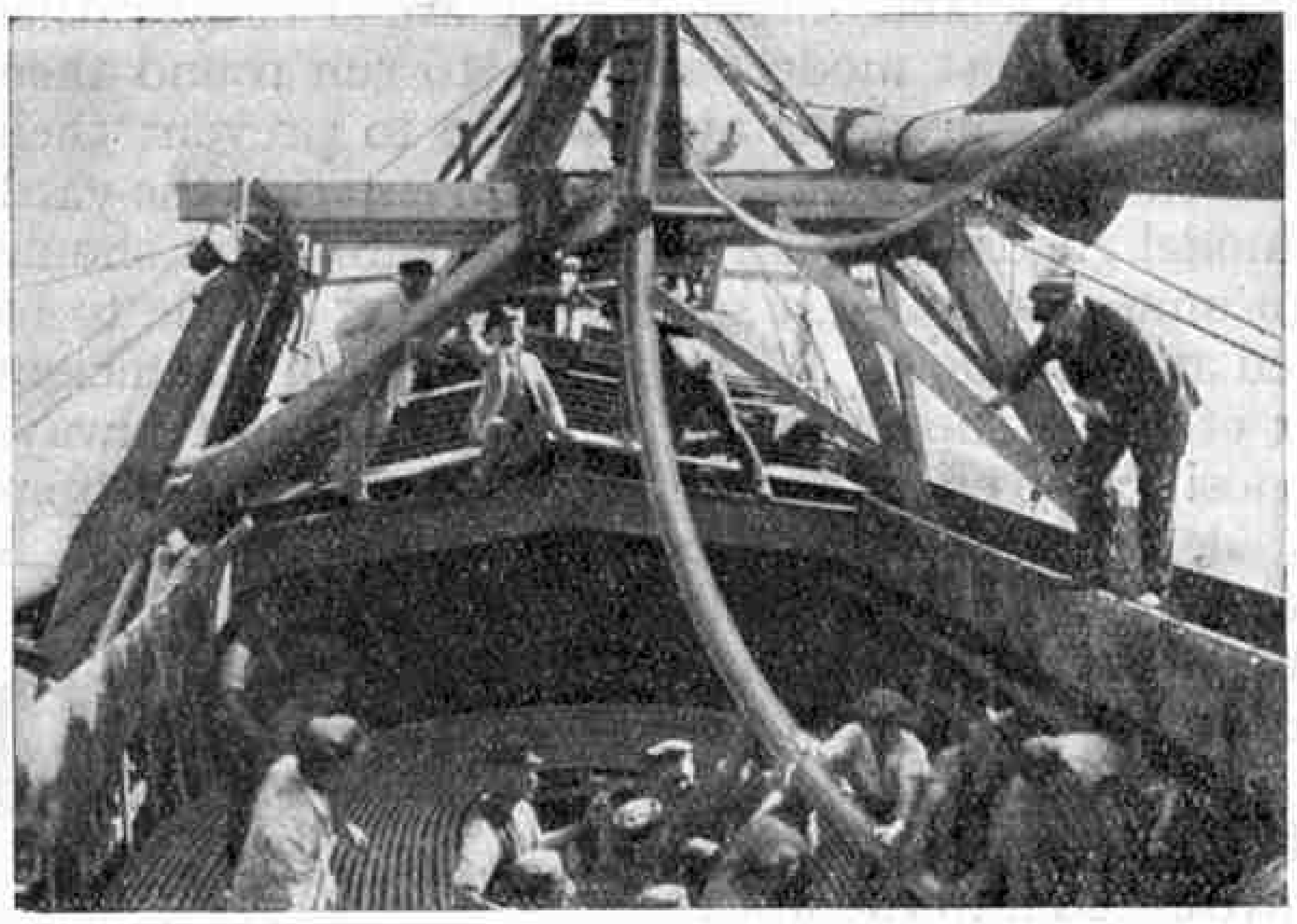
by G. Mülle

UNTIL the year 1919 direct communication between Germany and Sweden was carried on by means of two telegraph cables that crossed the Baltic Sea at its narrowest part and connected the Island of Rügen with Trelleborg on the south coast of Sweden. The earlier of these cables was laid in 1865 and it remained in constant use over a period of 62 years. It had to be abandoned in 1927 as it was no longer possible to maintain it in satisfactory condition. The second was the gutta-percha cable laid in 1898, which is still in use.

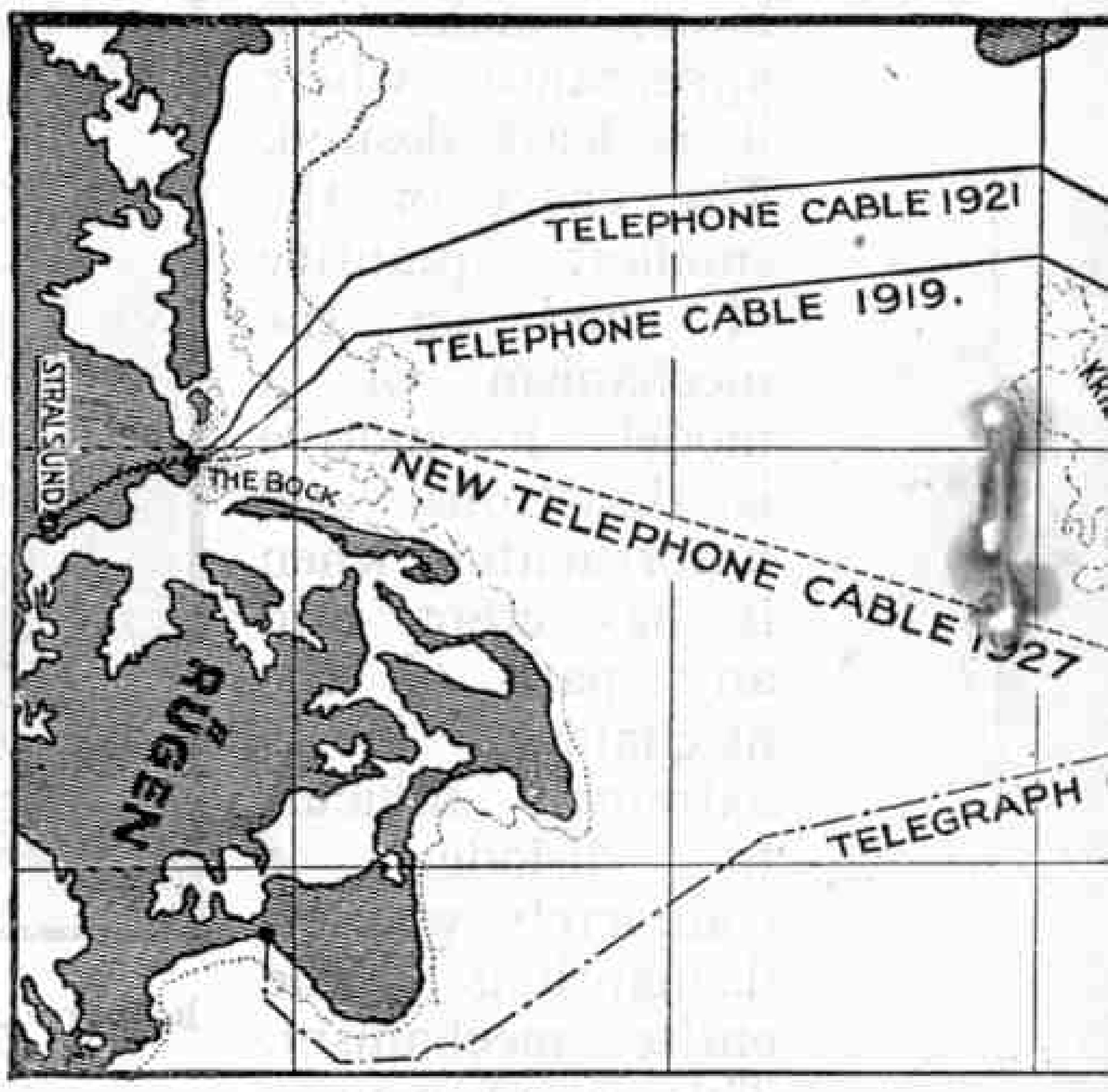


Twenty-five miles of cable coiled up in one of the tanks of the *"Norderney"*

The increasing importance of telephonic communication led in 1919 to the laying of a special cable from the neighbourhood of Stralsund to Kämpinge on the Swedish coast, and this was followed two years later by a second. It was evident that still a third cable would soon be necessary to cope with the ever-growing demand, and accordingly an additional route was surveyed on which a new cable was successfully laid in 1927. This cable is a fine example of modern practice and its construction and laying present features of great interest.



A loading coil portion of the cable passing from the tanks to the paying-out machines



The telegraph and telephone cables co

In surveying the route it was realised that a departure from that followed by the already existing cables would be necessary. Almost half-way between Sweden and Germany, and on a direct path between the shore stations, is a bank known as the Kriegers Flak, the rocky ground of which would have been dangerous to cables crossing it. The earlier cables were taken round the western side of the bank. It is inadvisable to lay cables too near each other, owing to complications that may ensue if it becomes necessary to raise them for repairs; and it was decided, therefore, that the new cable should be laid on the eastern side of the bank, as a route sufficiently far to the west to clear the two existing cables would involve too great a detour.

Another obstacle was an island off the German coast that it was necessary to cross. This is called the Bock, and is about one-and-a-quarter miles in width. It is completely submerged at high tide, and a northerly wind sometimes raises the depth of water on the island to as much as five feet.

The existence of the Bock made it necessary to carry out the work in three portions. First, a short length was laid from the coast across the shallow Barth Channel that intervenes between the shore and the Bock. Then the second portion was carried across the Bock to the point on its northern shore at which the junction with the deep water portion was to be made. Finally, the main portion of the cable was laid from the cable steamer *"Norderney."*

At work on the cabl

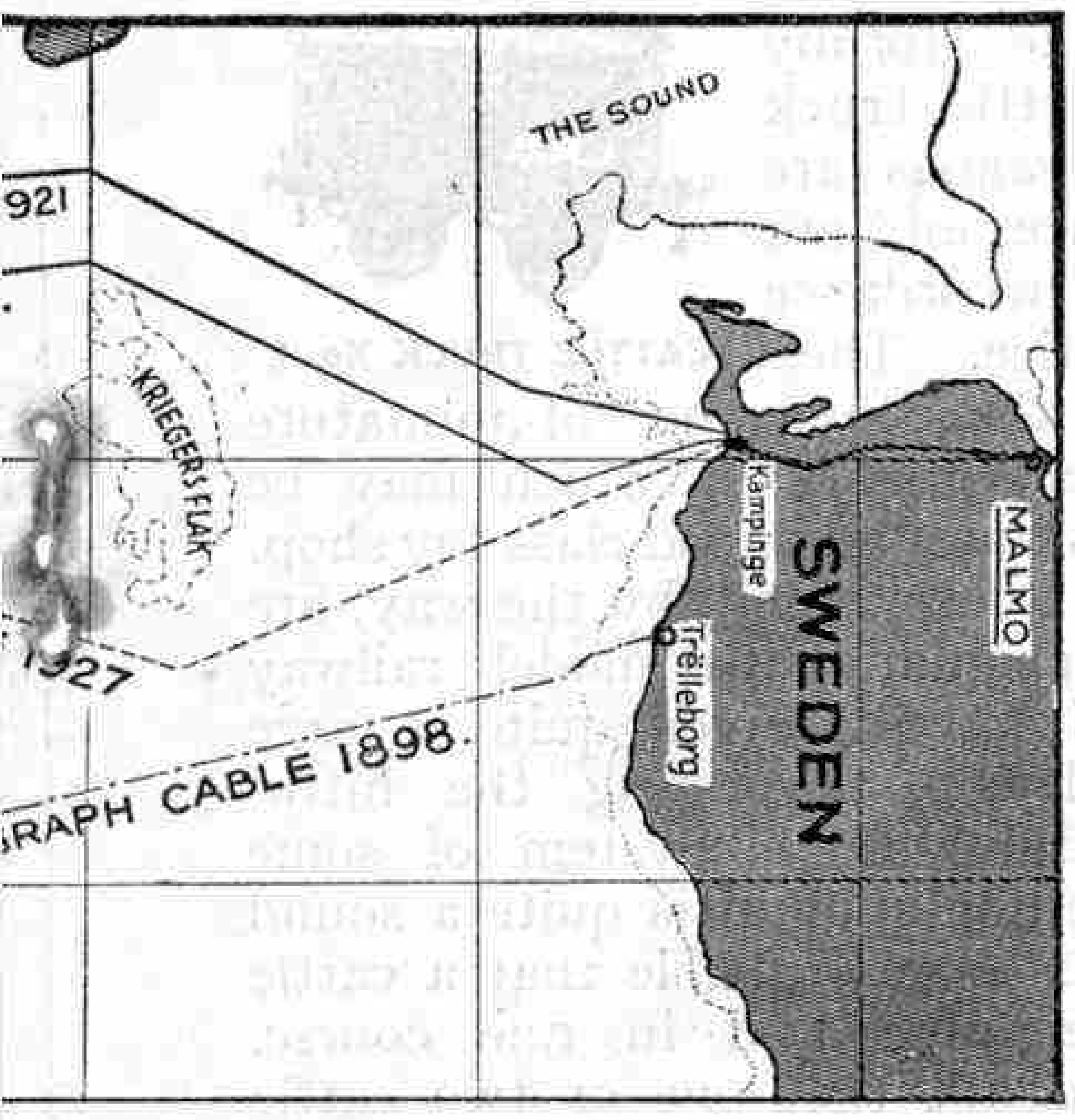
The Barth Channel offered no difficulty, the cable being successfully laid from a flat-bottomed lighter, a vessel of small draft being necessary as the depth of the channel is little more than 6 ft. The length of cable required for crossing the Bock was put down in large windings on the southern shore of the island and carried across. This was a laborious process necessitating the employment of over 200 men, who worked for several days under a broiling sun. The work of dragging the cable along was specially difficult on the wet sand of the northern shore of the island.

Handling the portions containing the loading coils was a very strenuous business, as these weighed 4 cwt. each. In them were

able Across the Baltic:

n Shallow Waters

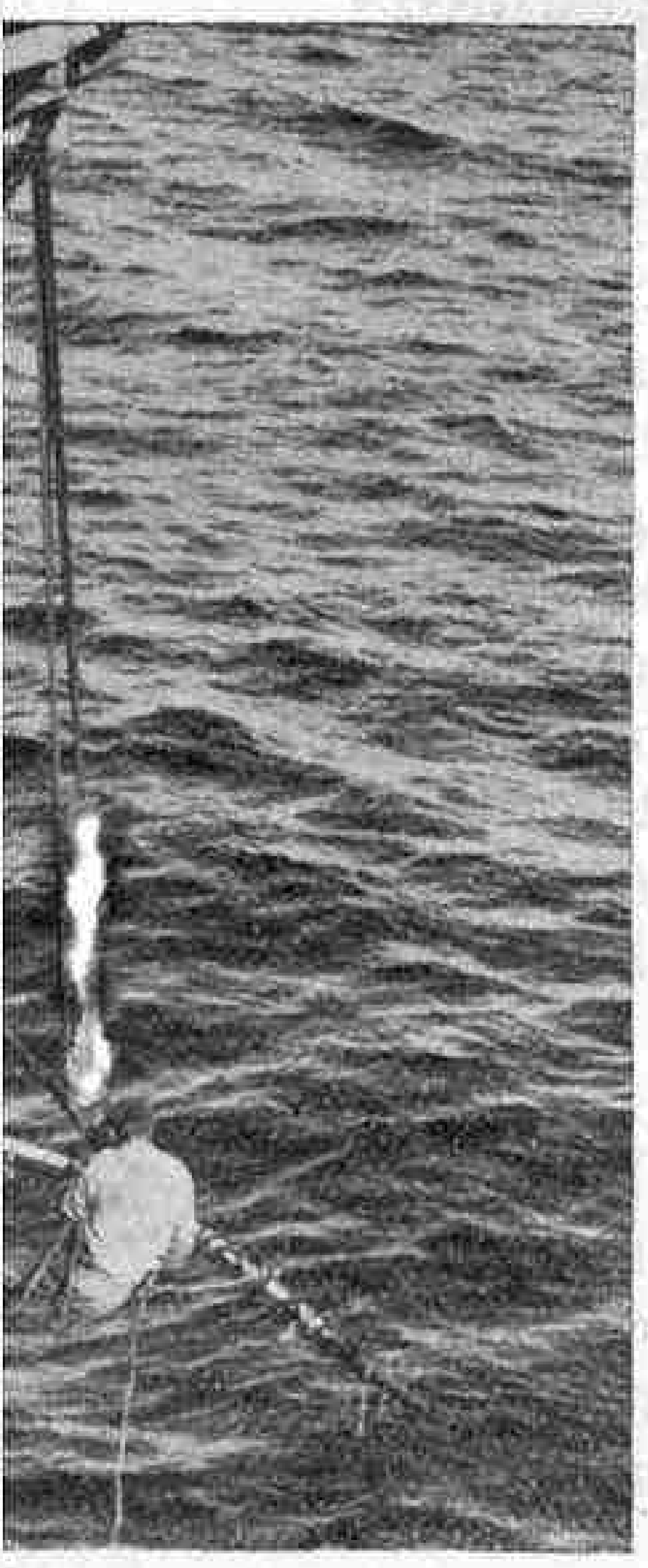
üllenheim



bles connecting Germany and Sweden

the inductance coils used to prevent attenuation of the strength of the signals during their passage through the cable. The coils are usually wound on cores made of fine iron wire or of iron dust pressed into shape with the aid of some binding material. Their use was introduced by Pupin, a native of Servia, who is now a well-known scientist and inventor in America.

While this length of cable was being carried, the lighter moved round to the northern shore of the Bock, where it laid the portion of the cable still aboard on a line extending six miles from the shore, the course being marked by balloon buoys. The outer end of this cable was sealed with a lead cap and fixed to an anchored buoy to await connection later on to the main cable. The shore end was then spliced with the end of the portion that had been carried across the Bock.



he cable in mid air

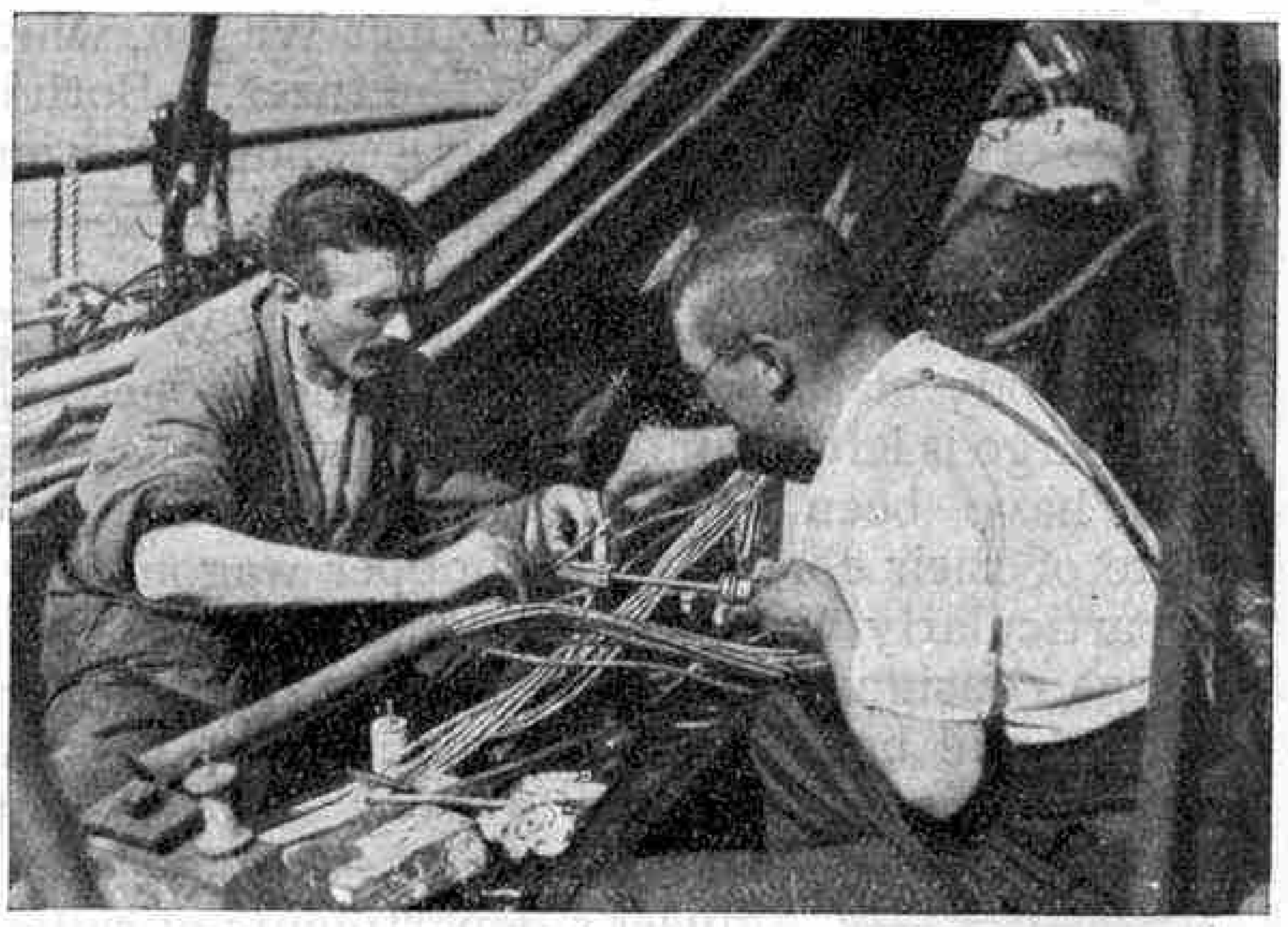
All was now ready for laying the main cable. This was brought from the factory, coiled on special trucks, to Nordenheim on the Weser, and there piled in huge tanks to undergo exhaustive tests. It was then transferred in one length of 67 miles to the tanks of the cable steamer "*Norderney.*"

The cable steamer left her native port on 21st August, passed the mouth of the Weser and the North Sea, sailed on the following day through the Kiel Canal, and began on 23rd August to lay the buoys which, as floating sign-posts, were anchored along the route at distances of six to eight nautical miles. Haze and rough sea compelled the steamer to return after having laid the third buoy, however, and to anchor under the shelter of Rügen.

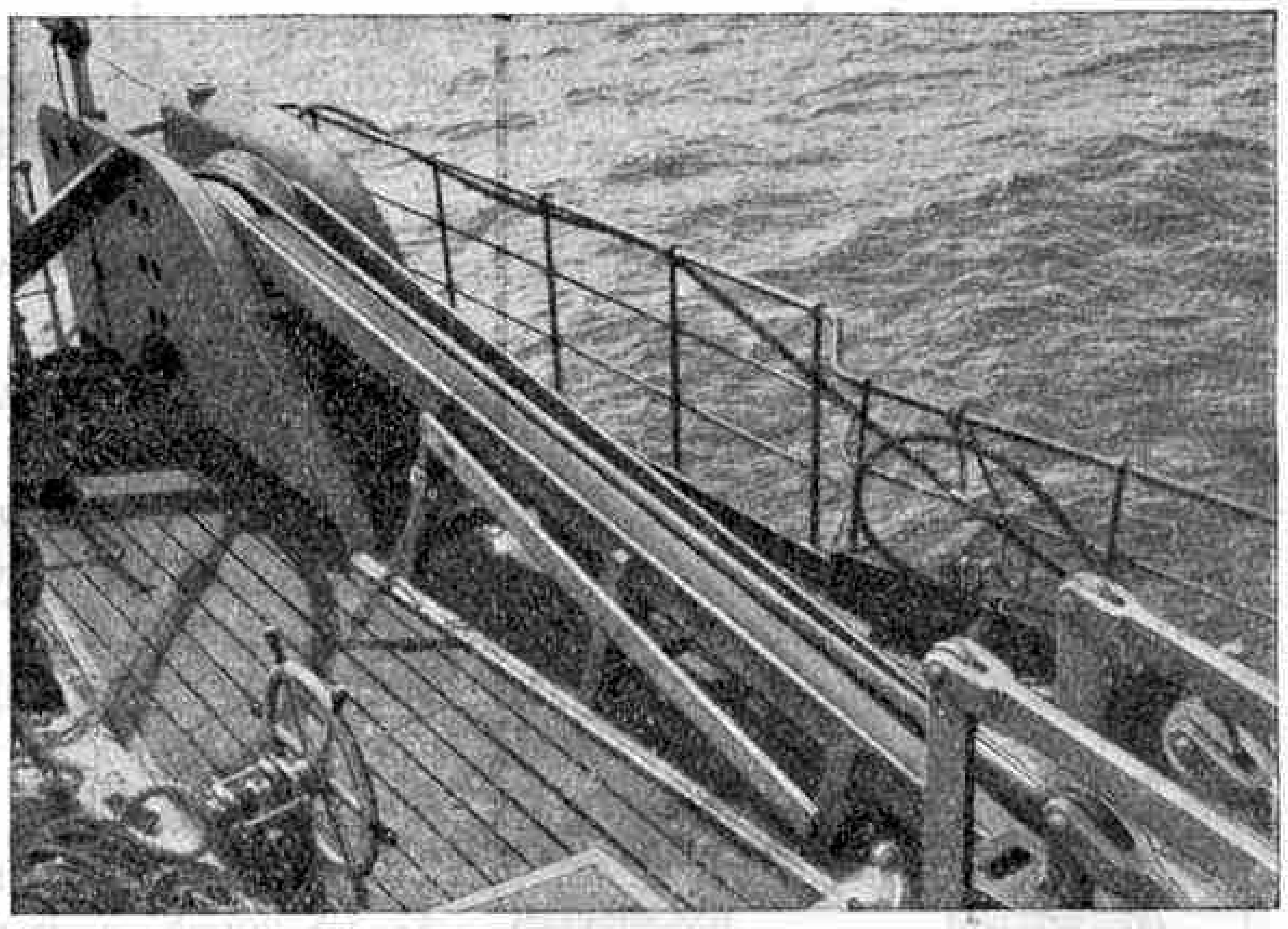
On the following two days the laying of the buoys was completed, in spite of the stormy sea, and soundings were taken in the bay of Kämpinge. On the return voyage to the German coast the positions of the buoys were verified and the "*Norderney*" finally anchored near the buoy indicating the end of the shallow-water cable previously laid from the flat-bottomed lighter. The end of the shallow-water cable was then hauled on board over the stern sheave. Two hours' later telephonic communication started with the shore-end station, and repeated tests proved that this portion of the cable was in perfect condition.

The task of joining the two portions of the cable followed, and after 12 hours of hard work the splice was at last finished. Unfortunately, all this labour was thrown away. Ominous signs appeared that a gale was approaching, and in such conditions it was inadvisable to commence to lay the cable. It was therefore decided to cut the cable. This was done, and the end of the shore-cable was buoyed up once more and anchored.

This was, of course, a serious decision, but during the night it was proved to have been a very wise one. The weather rapidly became extremely bad, and scarcely had the cable buoy been lowered when the gale increased to such an intensity that the "*Norderney*" commenced to drag her anchor. It was evident that she could make no attempt to ride out the gale, and therefore she fled for shelter towards the Swedish coast, pitching violently on the short and heavy seas. Still the violence of the gale increased, waves swept the struggling steamer from stem to stern, and finally she had to seek shelter in the harbour of Trelleborg.



Completing the work. Making the final splice



Guide along which the cable runs to the stern-sheave

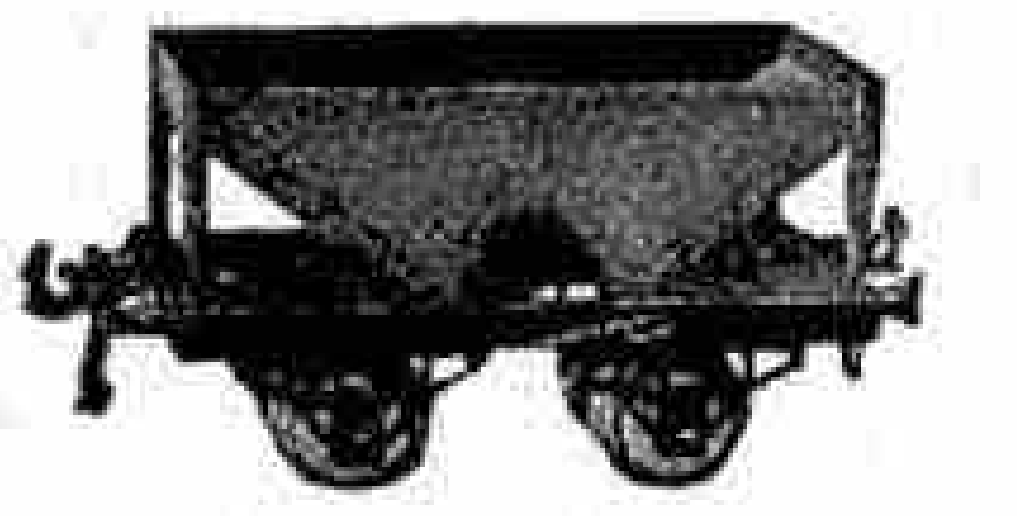
As soon as the weather moderated sufficiently the "*Norderney*" again put out to sea and recommenced operations.

(*Continued on page 340*)

Rolling Stock of the Hornby Series

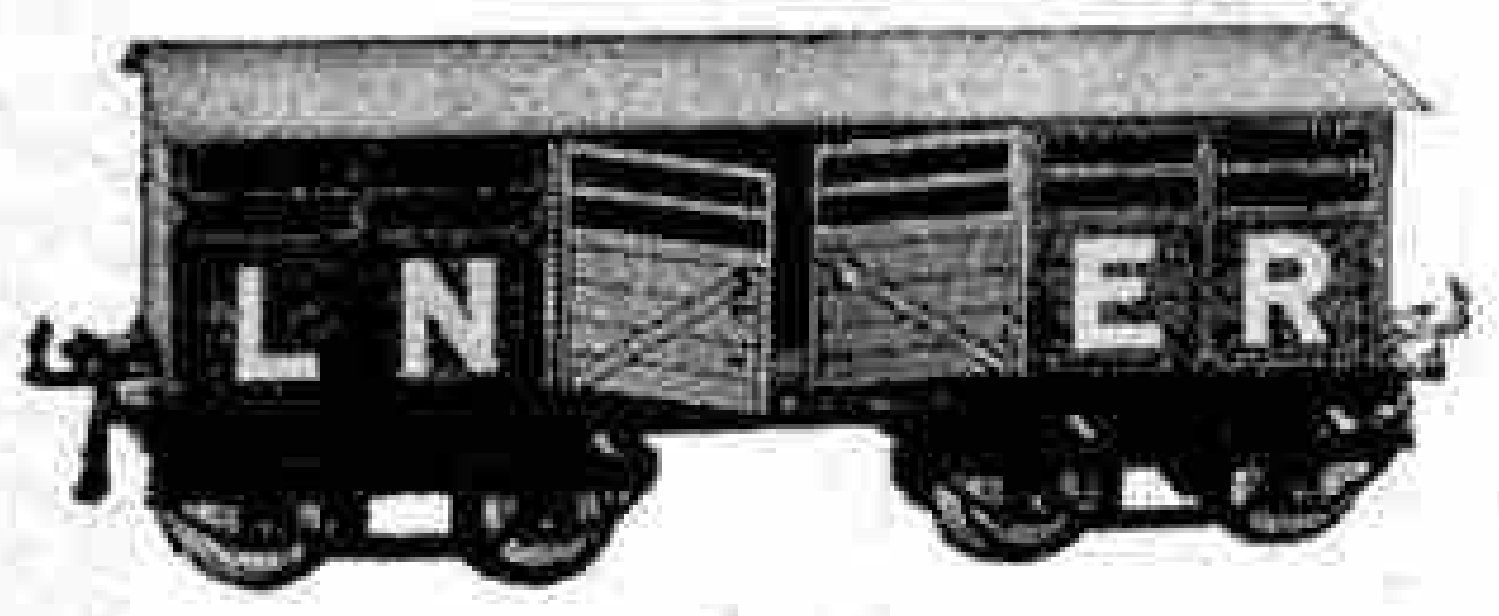
By 'Tommy Dodd'

IN continuation of my survey of the various types of rolling stock of the Hornby System, I will deal first this month with the three special types of mechanically unloading wagons known respectively as the Hopper Wagon, the Rotary Tipping Wagon, and the Side Tipping Wagon. These three pieces of rolling stock have an interest that is peculiarly their own, and they certainly should find a place on every miniature railway.



HOPPER WAGON

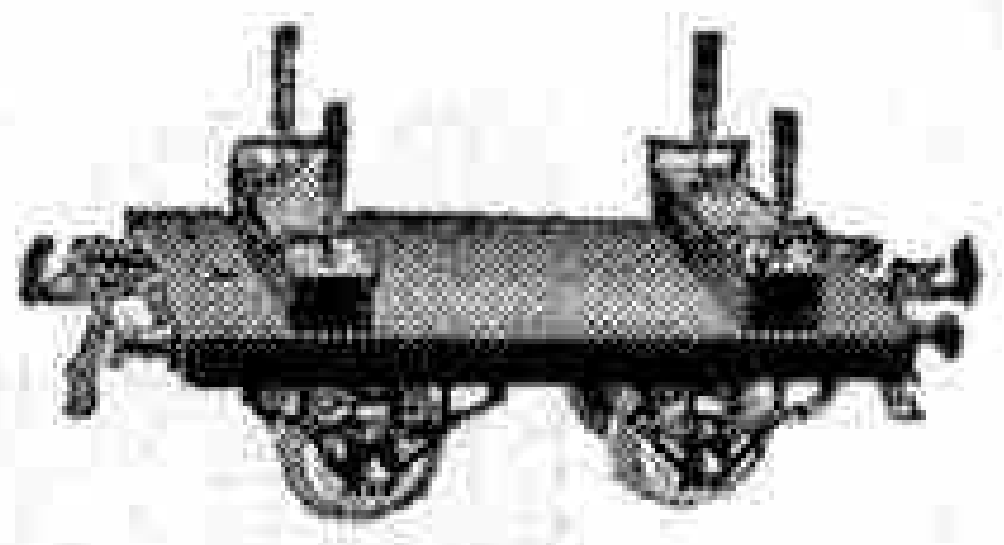
I will commence with the Hopper Wagon, which to my mind is the most interesting of the three. Both in actual practice and in Hornby practice hopper wagons are unloaded mechanically by means of two special doors in the underside of the body. The sloping ends and centre of the "W" shaped body of the wagon ensure that none of the cargo is left behind when the unloading doors have been opened. Owing to the nature of their construction, hopper wagons are particularly well suited to the transport of large consignments of ballast for the construction or repair of rail beds or embankments, and for this reason these wagons are used to a very large extent in the service of the constructional engineer's departments of railways.



CATTLE TRUCK No. 2

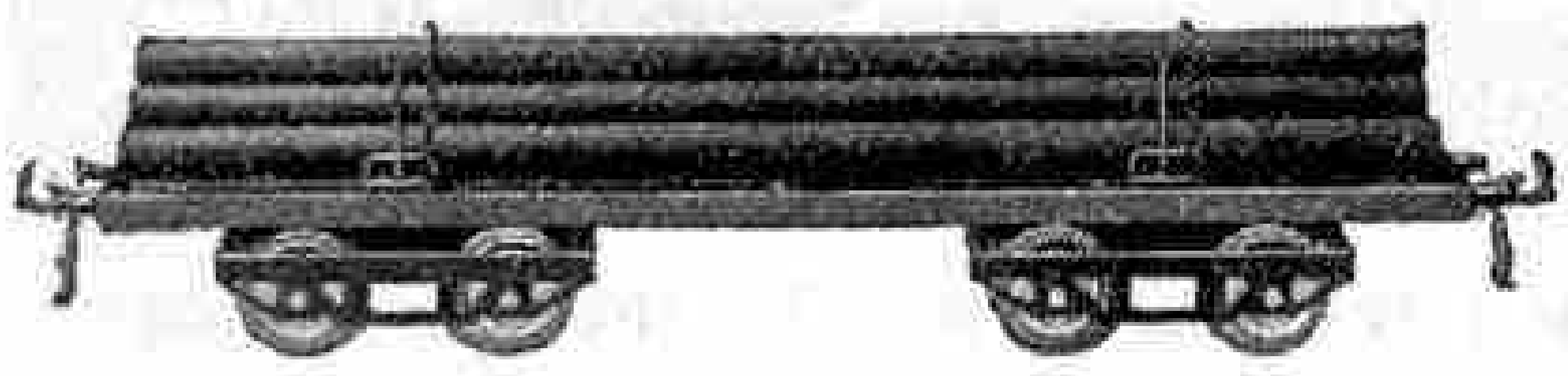
SIDE TIPPING WAGON

The Side Tipping Wagon is another type that is very largely favoured by railway constructional engineers. It consists of a trough-shaped container, supported at both ends by stands in which are cut long slots. When it is required to unload one of these wagons, a safety catch is released, and then all that is needed is a slight push to complete the whole operation. The Hornby wagon is a very realistic model, and it operates in almost exactly the same manner as the wagons in actual practice. A train of half a dozen of these wagons standing on a branch line with a tank engine at the head looks exceedingly well, and adds greatly to the realistic appearance of any model railway.



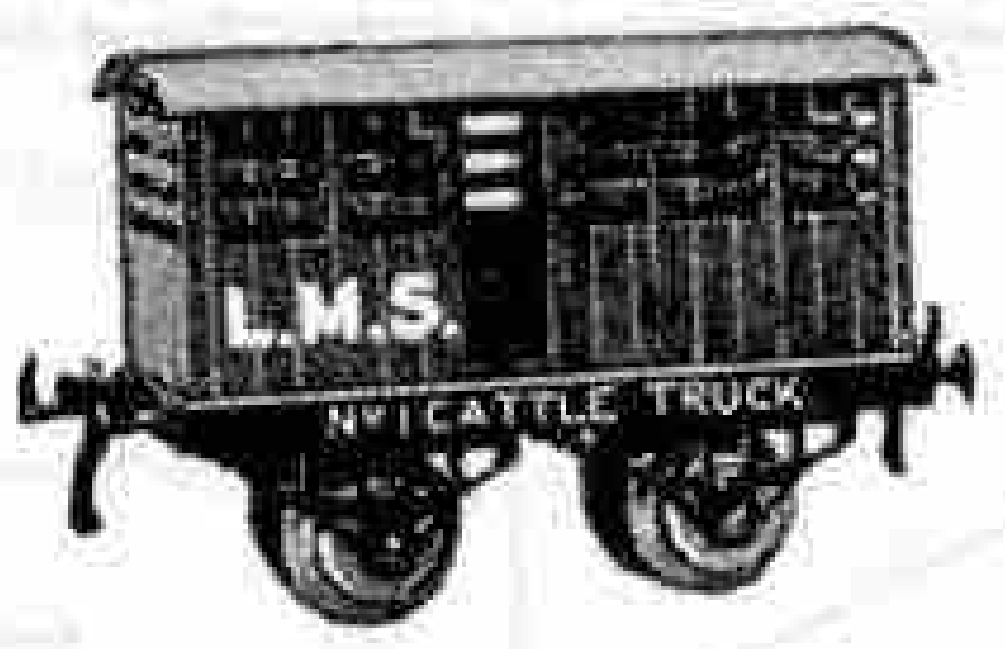
LUMBER WAGON No. 1

The third type of mechanically unloading wagon is the Rotary Tipping Wagon. These wagons are used by most large contractors, and also by the constructional engineers of railways. They are almost always to be seen in large numbers in the neighbourhood of quarries and in all places where constructional or demolition work is being carried out. The body of this wagon is constructed in such a manner as to swivel about the centre of the frame. In addition it may be tipped up, and the combined effect of the two movements is to make it a perfectly simple matter to unload the wagon on to the side of the track in a few seconds. On account of its convenience in this respect, this type of wagon is particularly suitable for the construction of railway embankments.



LUMBER WAGON No. 2

Leaving the mechanically unloading wagons, we come to the two types of cattle truck, known respectively as the Hornby Cattle Truck No. 1 and Cattle Truck No. 2. Both of these wagons are very realistic in appearance, and are suitably ventilated in accordance with actual railway practice. They should be used only for the conveyance of miniature cattle and other livestock, models of which may be obtained quite cheaply at almost any good class toy shop. In connection with these trucks which, by the way, are exceedingly popular with model railway enthusiasts, I have received quite a large number of letters suggesting the introduction to the Hornby System of some kind of cattle dock. This is quite a sound idea, and it is most probable that a cattle dock will be introduced in due course. There is no doubt that one or two cattle wagons standing by a cattle dock give a distinct air of realism to a model layout.



CATTLE TRUCK No. 1

Another interesting vehicle is the Lumber Wagon which, like the Cattle Truck, is made in two types, for use respectively with 1 ft. and 2 ft. radius curves. These wagons, especially the larger of the two, are very realistic in appearance. They are fitted with bolsters and stanchions in a similar manner to the wagons used for the transport of logs in actual railway practice. A further impression of completeness is given by the small chains that are provided for the purpose of securing the logs.

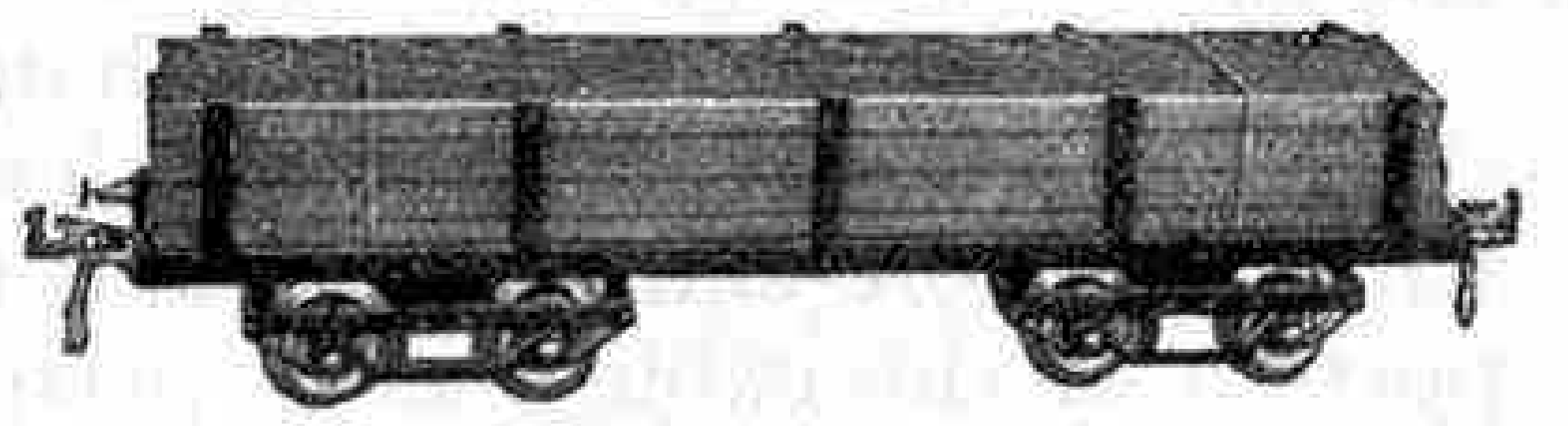
ROTARY TIPPING WAGON

To supplement the Lumber Wagon, there are two Timber Wagons, No. 1 and No. 2. These wagons are intended for the transport of sawn timber, and not for the unsawn logs that are carried on the lumber wagons.

TIMBER WAGON No. 1

It should be noted that both the Timber Wagons are supplied complete with a load of timber, while the No. 2 Lumber Wagon has a freight of logs. If required, the timber for either the No. 1 or No. 2 Timber Wagon may be purchased separately, the prices being 1d. and 2d. per set, respectively. The logs for the No. 2 Lumber Wagon are also obtainable, price 4d. per set.

The appearance of any goods yard may be made considerably more business-like if a number of the Hornby logs are stacked in one corner. The timber should always be loaded on to the trains by means of a crane, and the Hornby Platform Crane which is sold separately, is ideal for this kind of work.



TIMBER WAGON No. 2

H.R.C. COMPETITION PAGE

Missing Locomotive Links

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

HUNDREDS of difficult railway problems reach H.R.C. Headquarters daily, and in addition, very large numbers of letters arrive from keen members all over the world, asking for advice on various railway matters. The H.R.C. staff usually find no difficulty in complying with all the requests of these members, but the other day the Secretary received a letter which he had to admit, gave him the fright of his life.

This letter was tucked away among many others, but it could not be missed owing to the vivid red markings—“ Urgent ! ” “ Urgent ! ” “ Urgent ! ” It was from the secretary of a thriving Branch Company, and ran as follows :—

“ Dear Secretary,

I am in a terrible mess, and I really haven't the slightest idea what to do about it. You see, our Branch is holding the largest exhibition of the season on Saturday evening next. We have arranged a very interesting and bright programme, in which is included the running of a large and complicated service of miniature trains to timetable. We have rehearsed the timetable for a long time now, and we can work the whole of it through without a single mistake. In addition, we are demonstrating a system of signalling applied to the model railway of one of the members, and this item will be supervised by the member himself who will explain all details to the visitors. The main feature of the evening, however, is a lantern lecture on locomotives, by the Superintendent of the local locomotive running sheds, who is a keen model railway man.

“ The Superintendent sent his slides along early this evening with a request that I should arrange them in order according to the list contained on the first slide in the box. Now Mr. Secretary, this is where the tragedy comes in. Smith, my chum, who is one of our keenest members, had helped me to unpack the slides, and we had them all out on the table ready to commence arranging them in order. Suddenly there came a knock at the door. We were expecting Appleyard, but as he has a terrible habit of never arriving punctually we did not think he could be the knocker. We therefore wondered who it could be, and Smith went to the door to investigate.

“ Then I got a great shock.

“ ‘ It is Appleyard,' shouted Smith, ‘ and not a minute late either ! '

“ This was too much for me, Mr. Secretary. I happened to be looking at the first slide containing the index, and the shock of Appleyard arriving promptly led to a terrible disaster. The slide slipped from my hands and came to earth with a terrible crash. On its way down it hit the corner of a chair, which completed the destruction and reduced it to one mass of splinters. At first I did not quite realise what had happened, but slowly the distinct awkwardness of the whole situation crept over me. How was I ever to get the collection into order, with the index hopelessly splintered ?

“ I have tried to piece the slide together, but the only information I can gather from the bits I have collected is written on a piece of paper which I am sending to you.

No.	NAME.
–10–	B–a–k –a–c–
– –01	–dd– –l– – –a– –
–90–	–l– –es– –y – – –l
–44	M– –d –f A–t–l–t
5– –9	L– –c– – –i– –
–50–	P– –n– – o– –a– –s
2–7–	N– –h– –a–k
–92	R–v–r A– –n
– –01	– –an– –v– –y –a–tl–
–353	St– –h– – –d
–07	–i–ca– –in– –h–r–
– –6	–x–a–i–u–
–28–	– –ter– –lto
–00–	– –z– –by
–3–8	– – – –t–i– C– –i–e– –e–t
2–6–	–c–p–r–
–4–7	L– –d –i–dm–y of –l–t–
–46	P–n–r–go–
–7–	– –rra– –uo– – –l
–07–	C–r– –f– C– –t–e
5– –1	G– –y–ed–
6–9–	L– –r– –f B– – –a– –a– – –e
–5–7	–e–ef– –ds– –r–
–006	K–n– Ge– – –e –
4– –8	–tep–an–ti–
5–76	A– –n–o– –t
–4–	I– –ul–
–64–	R– –m– –d P– –nc– –e
–55–	–r–n–e –ala– –n–
–9–7	– –id– of – –mm– –moo–
4–8	– –r Tr– –tr– –
–13–	–e–ta
–5–0	T– –n–ui–
–25	Tr–v– –e H– –d
3– –	B– –f–s– –r–
–2–	H– – –in– – –n– –i–e

“ Please will you do your very utmost to try and give me the complete names and numbers of these engines ? I cannot make head or tail out of them, but I feel sure that the willing and experienced staff at H.Q. will make light work of solving this puzzle. Anxiously awaiting your reply . . . . ”

Without wasting a minute, the staff at H.Q. set to work, and within an hour a complete list of the names and numbers of the locomotives had been compiled and was already being rushed off to the post. How many H.R.C. members could have solved this list for themselves ?

No attempt should be made to solve the contest on the page of the Magazine. The list should be copied on to a large sheet of paper and then should be worked out bit by bit. When as many as possible of the names and numbers of the locomotives have been found, the competitor's name, address and membership number should be written clearly on the sheet, which should be put into an envelope and sent to Headquarters marked “ Missing Locomotive Links ” in the top left-hand corner.

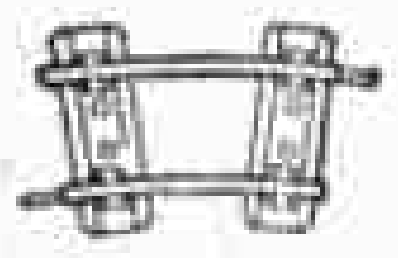
It should be remembered that the omission of the H.R.C. membership number from any entry will cause it to be disqualified immediately.

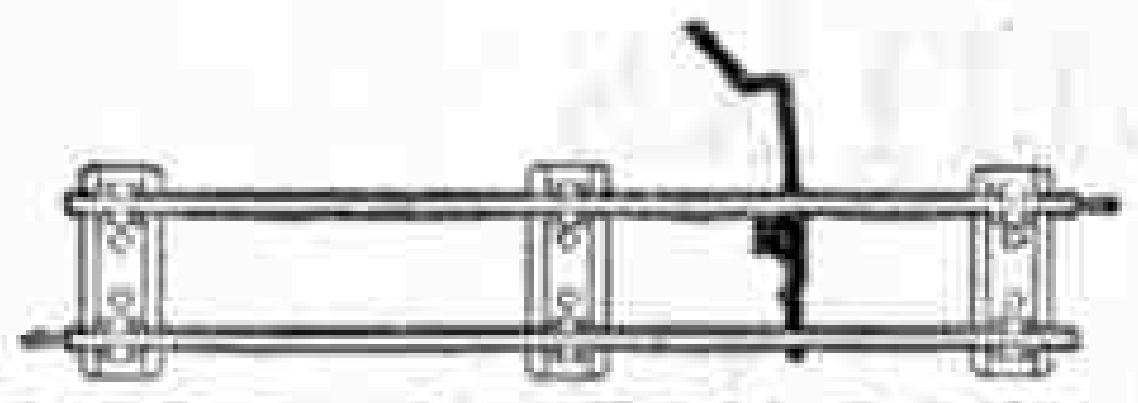
We are publishing the complete list, as sent to us by the unfortunate Secretary, to test the locomotive knowledge of H.R.C. members. Prizes of Hornby goods, or Meccano if preferred, to the value of £1/1/–, 15/–, 10/6 and 5/–, will be awarded to the four H.R.C. members who send into Headquarters the most neatly prepared correct solutions of the *names and numbers and owning railway company of each of the locomotives in the list.*

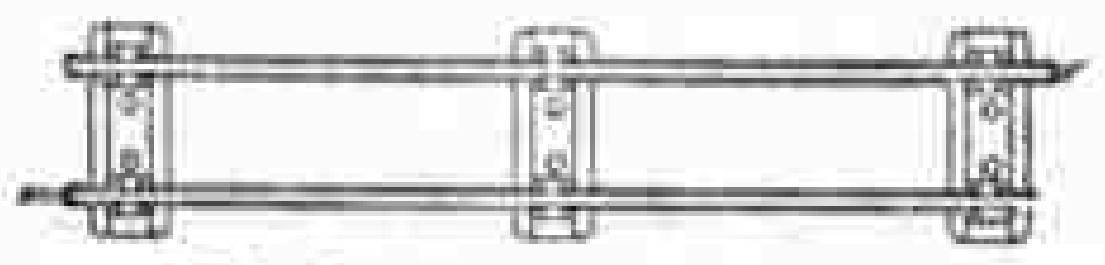
The competition will be divided into two sections—Home and Overseas. Closing dates, Home Section—30th April, Overseas—31st July.

HORNBY Rails Points and Crossings SERIES

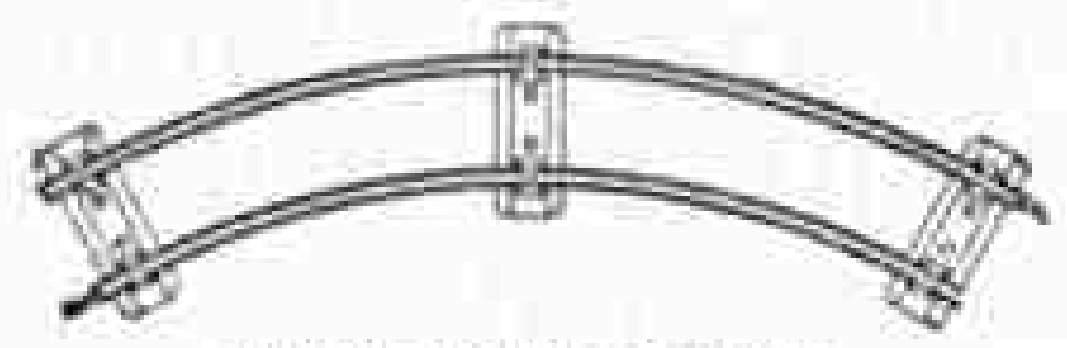
Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials obtainable are used in their manufacture.


A1¼ CURVED QUARTER RAIL

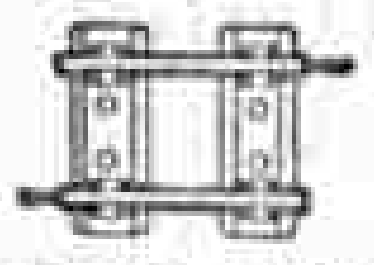

BB1 STRAIGHT BRAKE RAIL

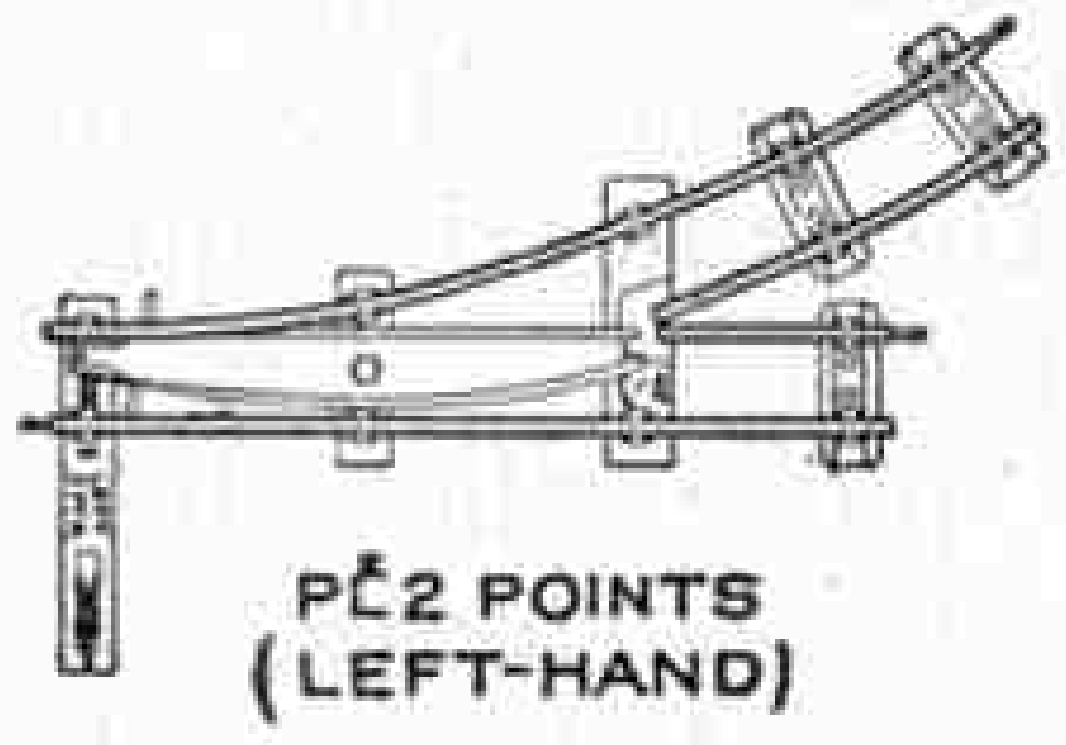

B1 STRAIGHT RAIL

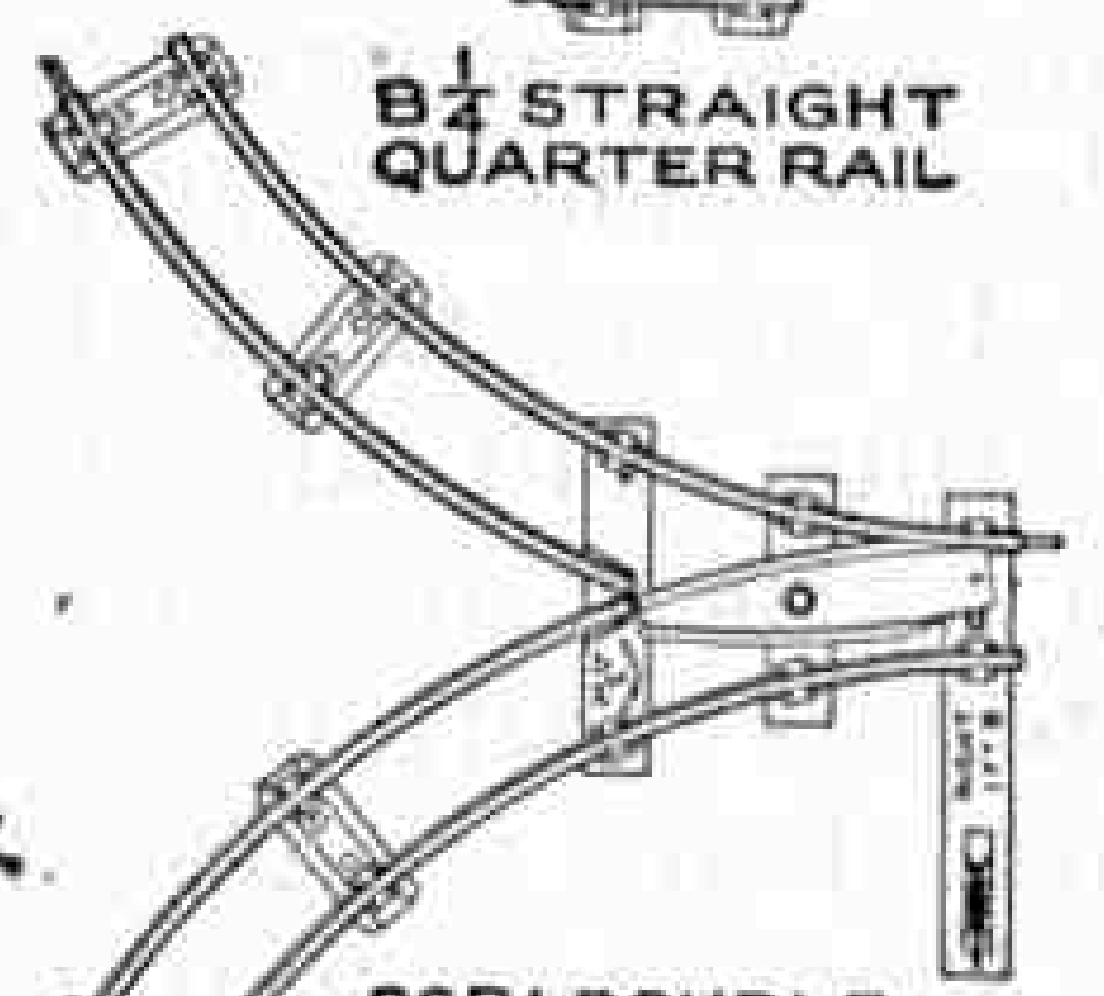
A1½ CURVED HALF RAIL

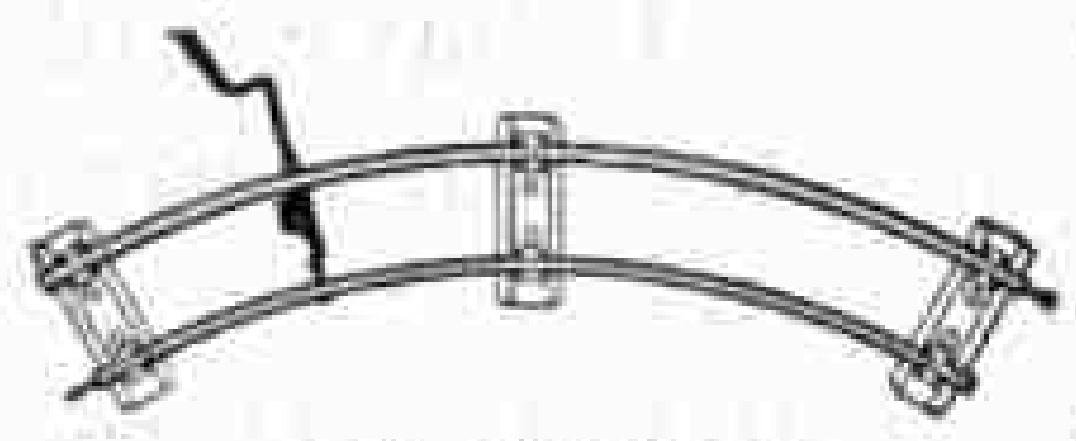

A1 CURVED RAIL

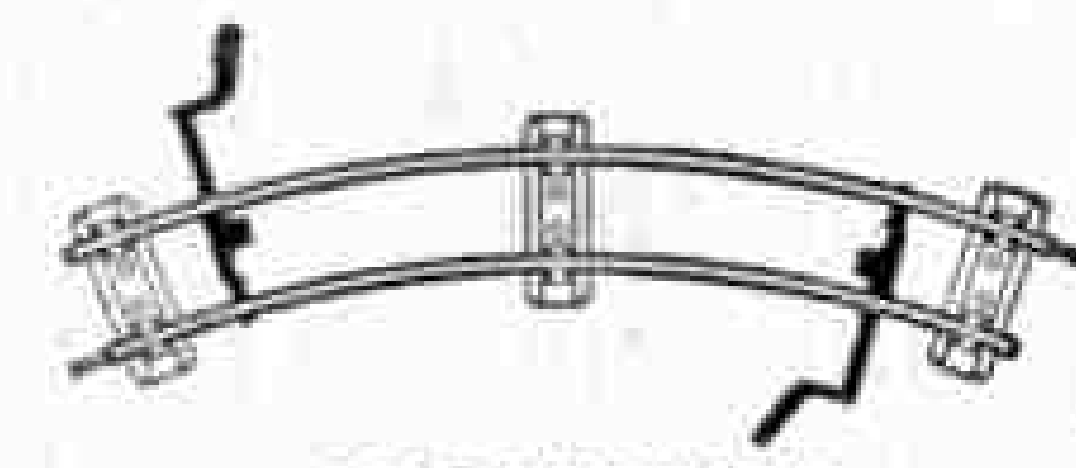
B½ STRAIGHT HALF RAIL

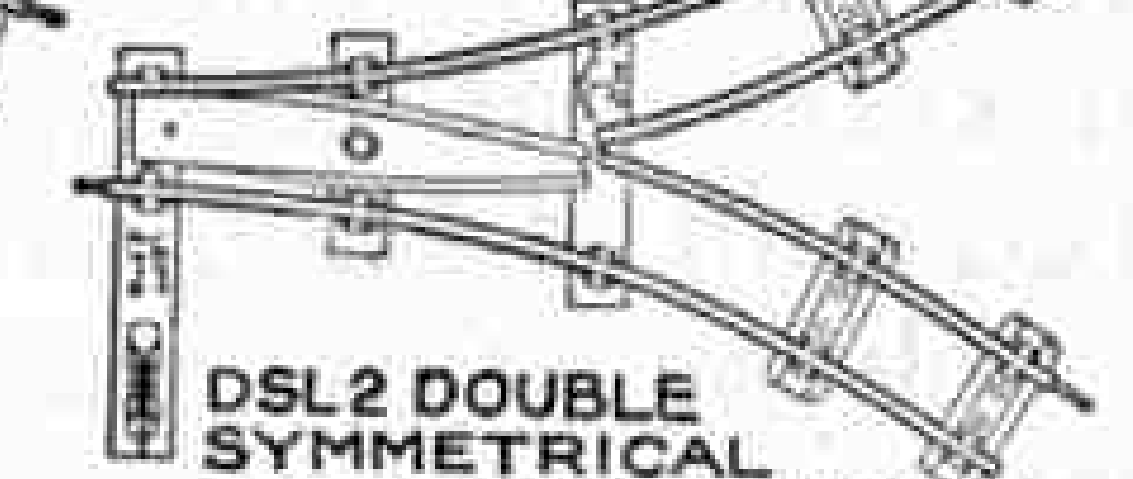

B¼ STRAIGHT QUARTER RAIL

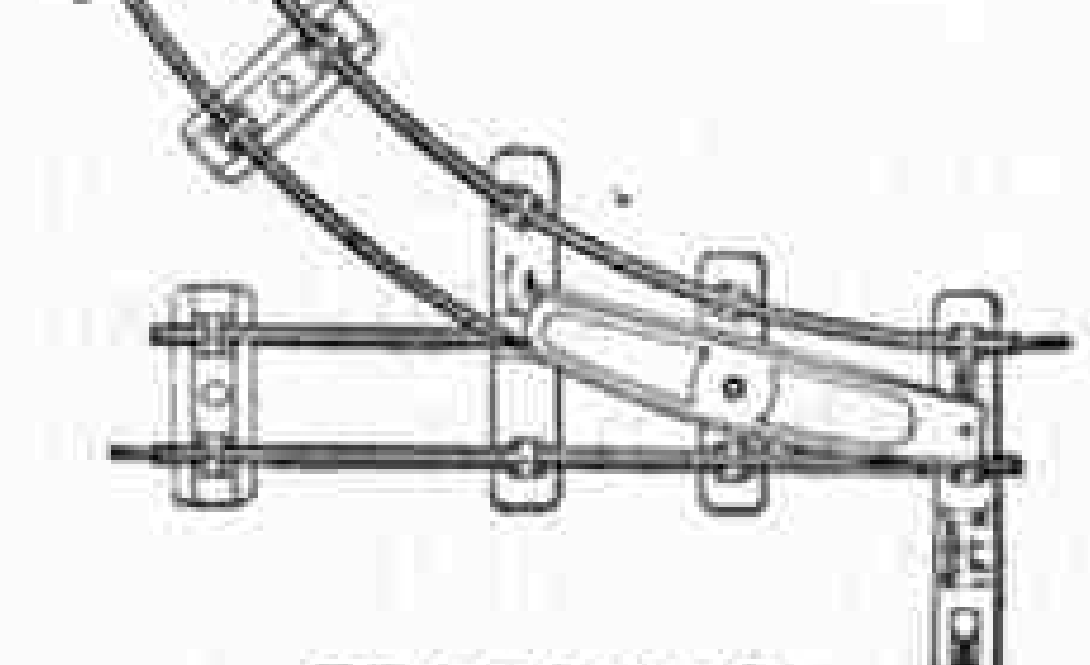

PL2 POINTS (LEFT-HAND)

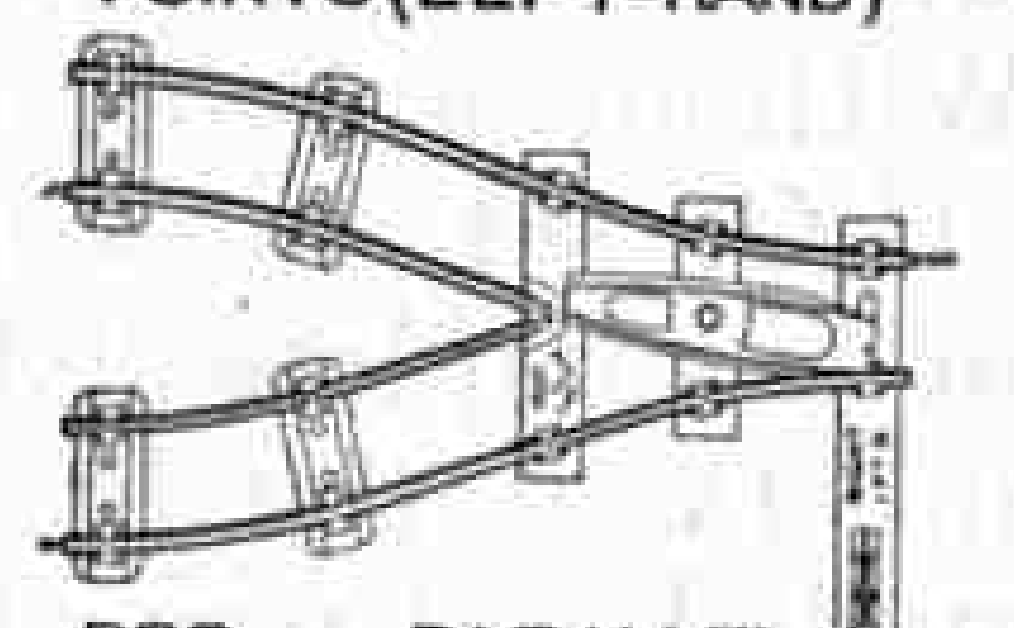

DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


AB1 CURVED BRAKE RAIL


AB2 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


PPR PARALLEL POINTS (RIGHT-HAND)

For Clockwork & Steam Trains

CURVED RAILS—1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	5/-

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/-
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/-
DSL2	Double symmetrical points, left		

PARALLEL POINTS—For 2-ft. radius curves

PPR2	Parallel points, right	... per pair	5/-
PPL2	Parallel points, left		

CROSSINGS AND CROSSOVERS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6
COR2	Crossovers, right hand ...	per pair	12/-
COL2	Crossovers, left hand ...		

POINTS—For 1-ft. radius curves

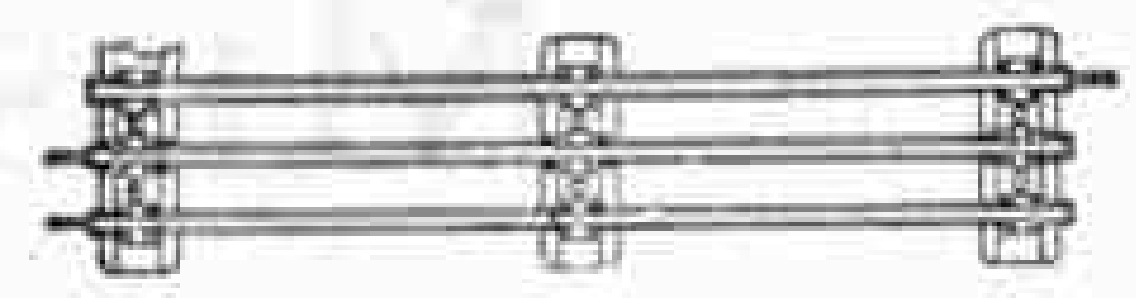
PR1	Right-hand points	... per pair	4/-
PL1	Left-hand points		

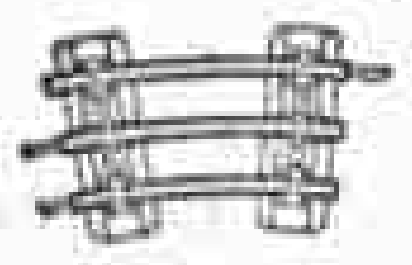
For 2-ft. radius curves

PR2	Right-hand points	... per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right ...	per pair	7/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left ...		

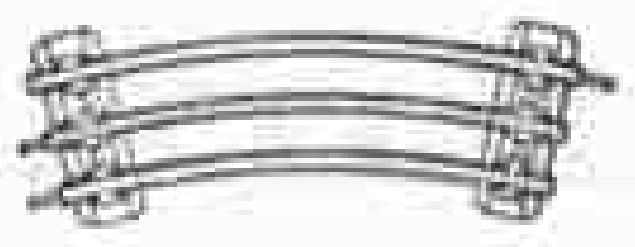
STRAIGHT RAILS

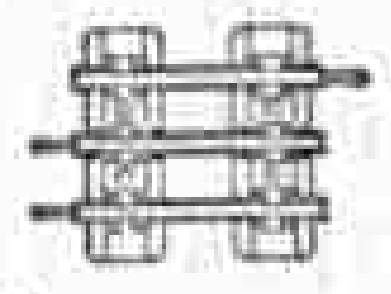
B1	Straight rails	per doz.	4/-
B½	Straight half rails	„	3/-
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	4/6
RCP	Rail connecting plates	„	4d.

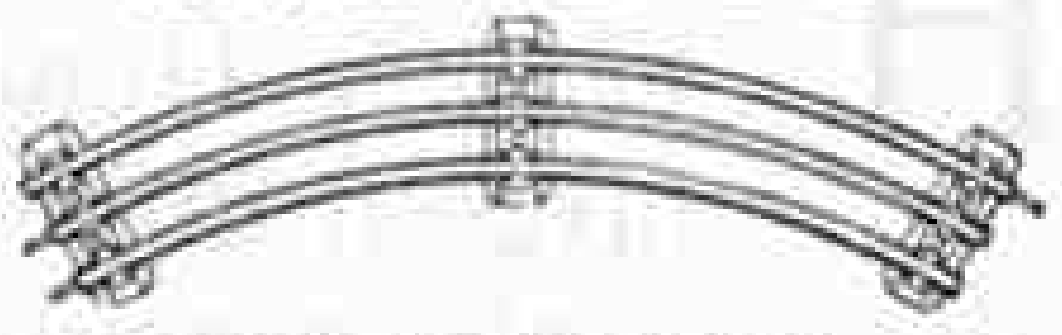

EB1 ELECTRICAL STRAIGHT RAIL

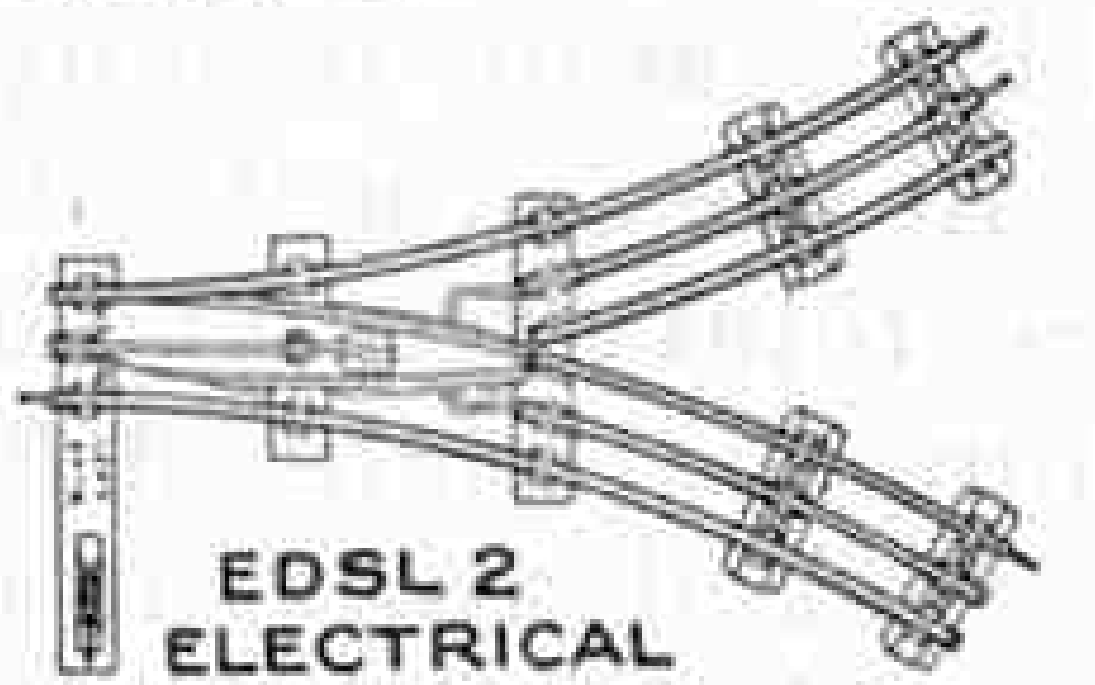

EA1¼ ELECTRICAL CURVED QUARTER RAIL

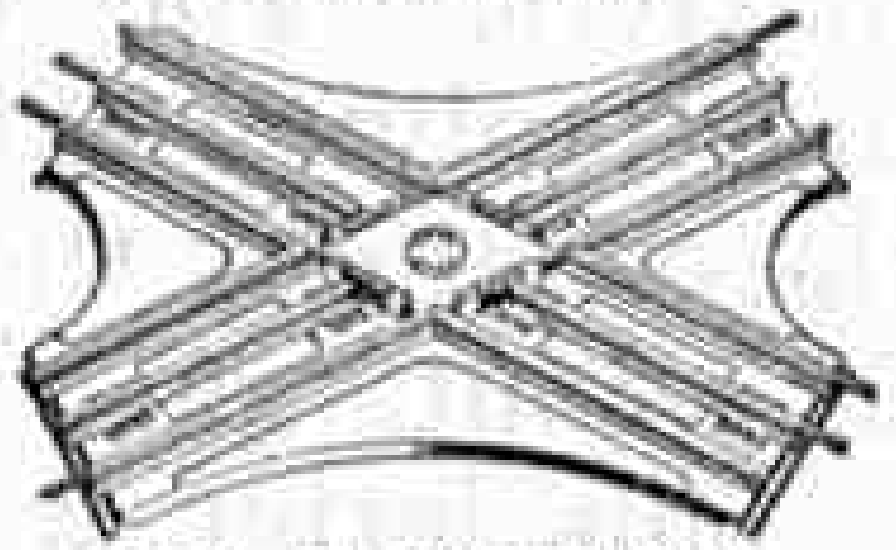
EB½ ELECTRICAL STRAIGHT HALF RAIL

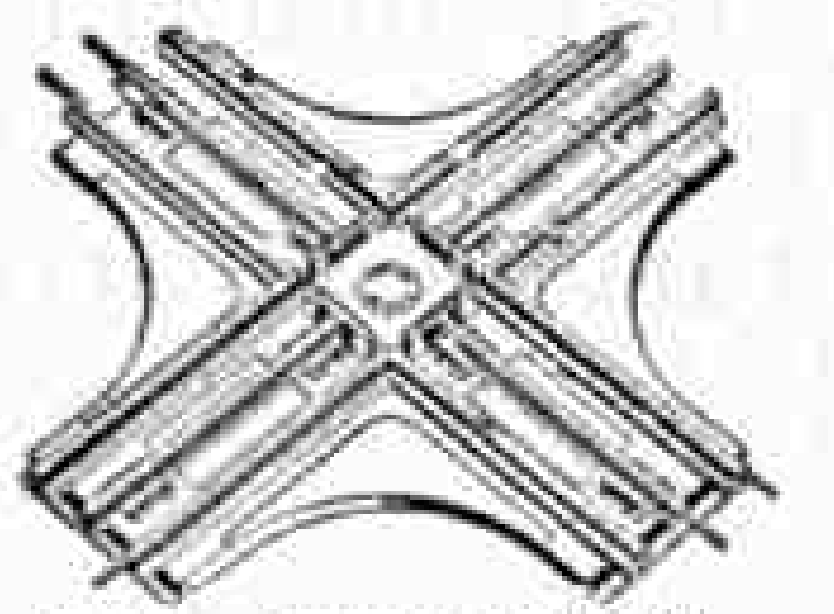

EA1½ ELECTRICAL CURVED HALF RAIL

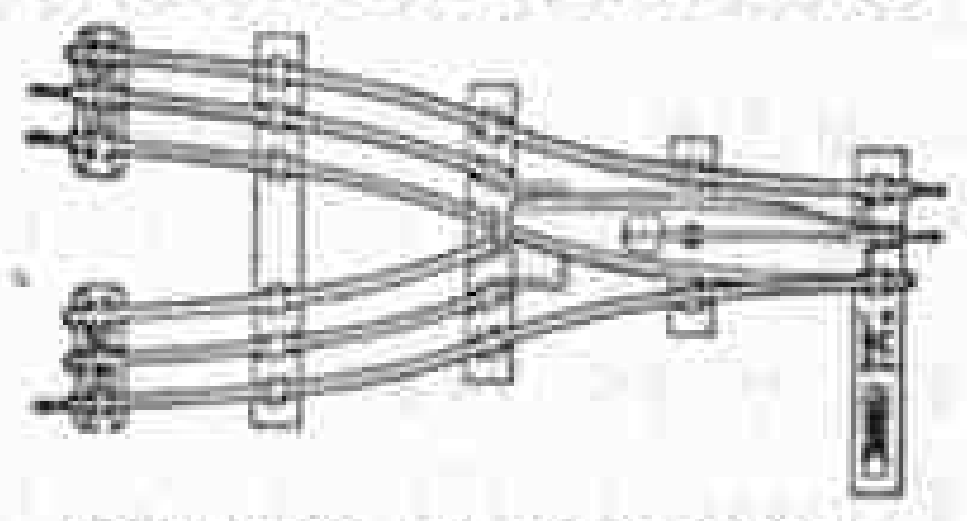

EB¼ ELECTRICAL STRAIGHT QUARTER RAIL

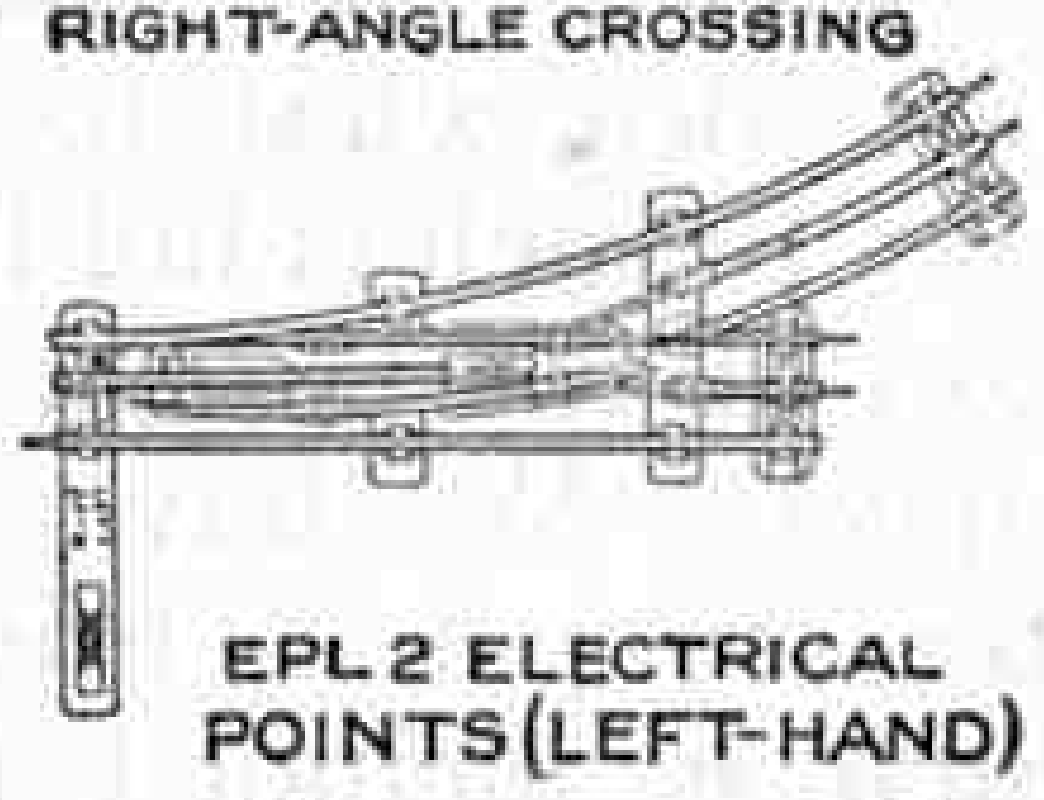

EA1 ELECTRICAL CURVED RAIL

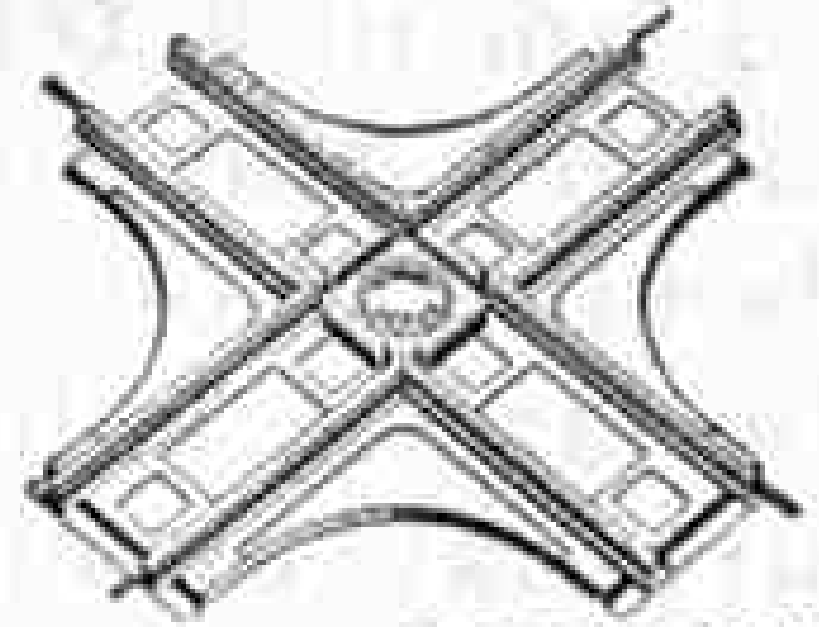

EDSL 2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)

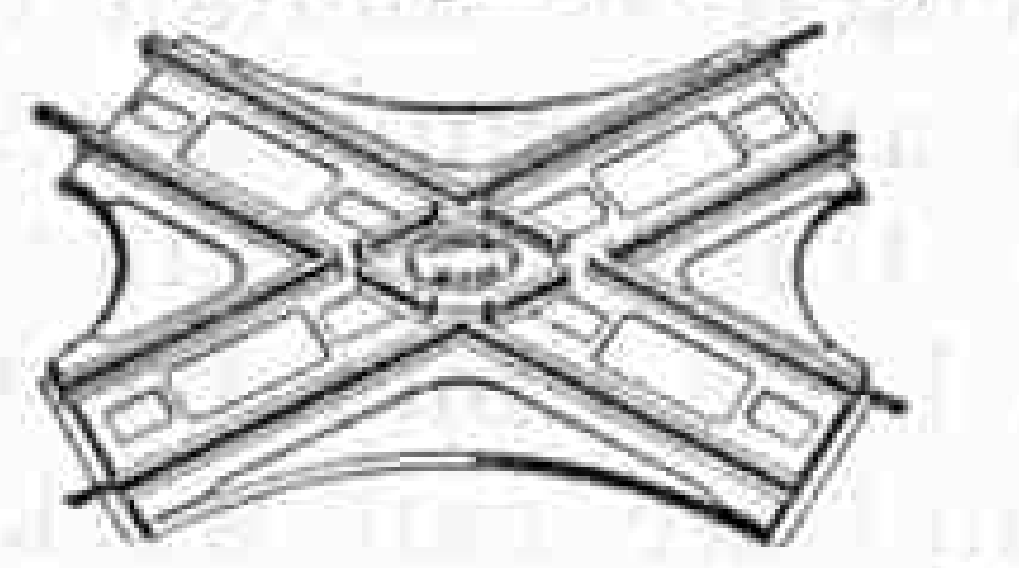

ECA ELECTRICAL ACUTE-ANGLE CROSSING

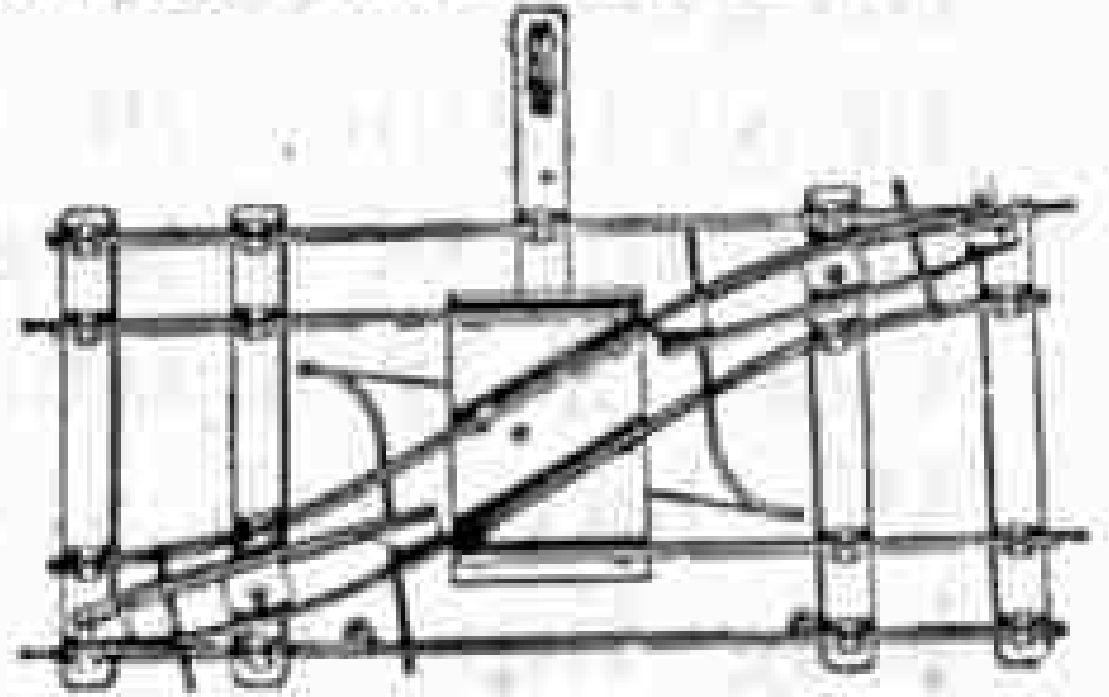

ECR ELECTRICAL RIGHT-ANGLE CROSSING


EPPR 2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


EPL 2 ELECTRICAL POINTS (LEFT-HAND)


CR1 RIGHT-ANGLE CROSSING


CA1 ACUTE-ANGLE CROSSING


CO CROSS OVER

Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	8/-
EA1½	Curved half rails	„	5/-
EA1¼	Curved quarter rails	„	4/6

2-ft. radius

EA2	Curved rails	per doz.	8/-
EA2½	Curved half rails	„	5/-
EA2¼	Curved quarter rails	„	4/6

CROSSINGS

ECA	Acute-angle crossings	each	4/-
ECR	Right-angle crossings	„	4/-

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	... per pair	10/-
EPL2	Left-hand points		

For 2-ft. radius curves

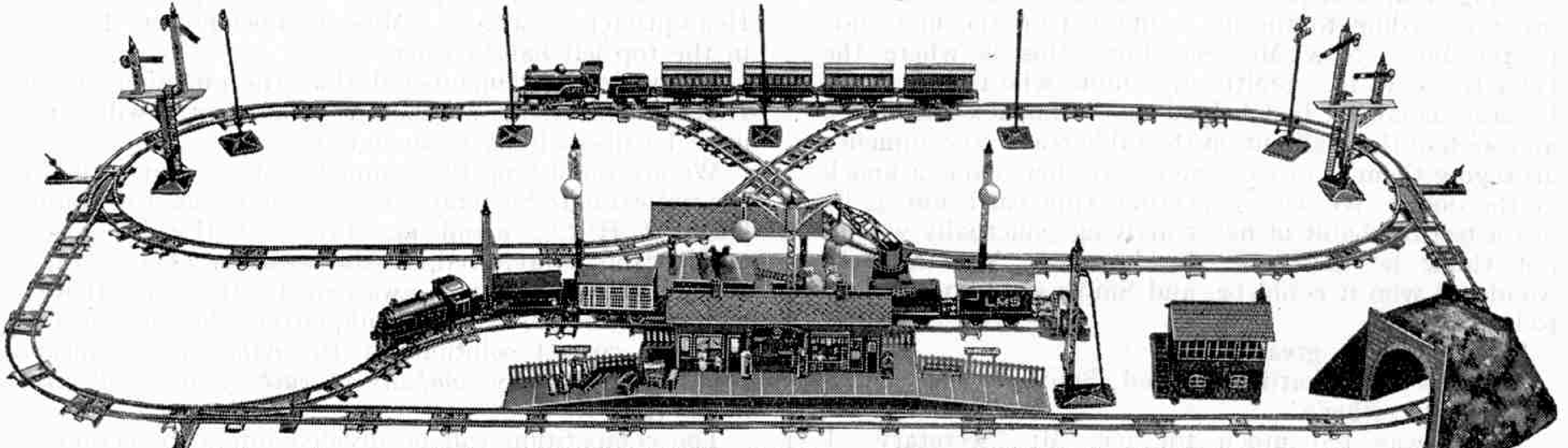
EDSR2	Double symmetrical points, right...	per pair	12/-
EDSL2	Double symmetrical points, left		

For 2-ft. radius curves

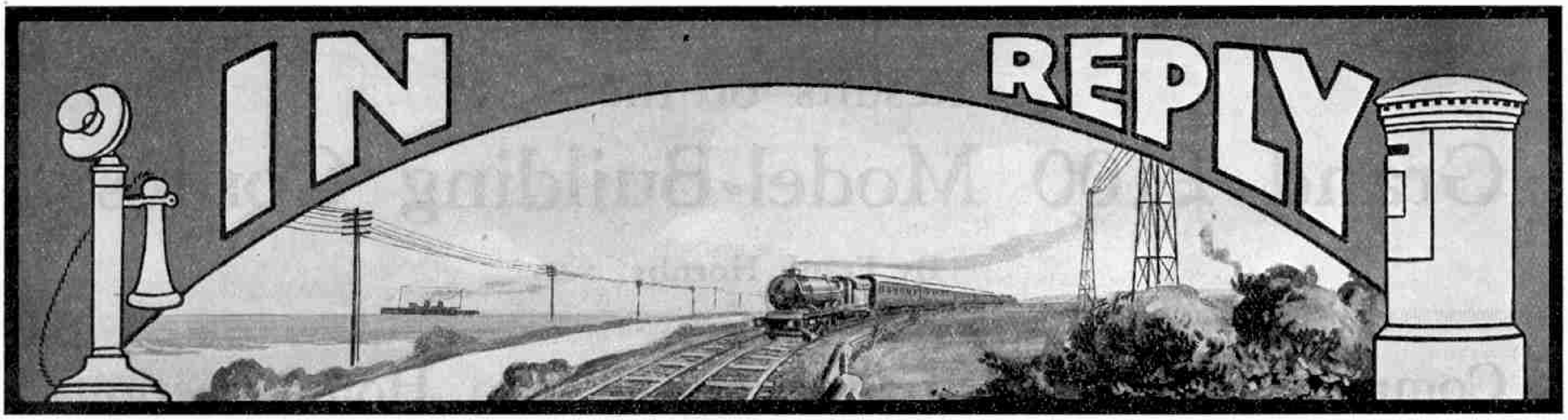
EPPR2	Parallel points, right	per pair	12/-
EPPL2	Parallel points, left		
TCPL	Terminal connecting plates (low voltage)	each	1/6
TCPH	Terminal connecting plates (high voltage)	„	1/6

Electrical Points for 1-ft. radius curves are not supplied

The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many similar illustrations and much useful information is given in a booklet entitled "How to get more fun out of Hornby Trains." This booklet is obtainable from your dealer price 3d. or from Meccano Ltd., Old Swan, Liverpool, price 3d. post free.



Manufactured by MECCANO LTD., OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

HORNBY WAGONS.—Your idea that we should supply Hornby wagons complete with tarpaulins is interesting. We do not propose to adopt it, however, as we consider that the present arrangement, whereby miniature tarpaulins may be bought separately when required, is far more convenient in the majority of cases. *(Reply to C. P. Phillips, Newton Abbot).*

LIGHTER LOCOMOTIVES.—We were rather surprised to receive your suggestion for a method of lightening our locomotives. We fail to see that such a reduction of weight could have any possible advantage and, as a matter of fact, we are now considering increasing the weight of our locomotives, in order to enable the maximum efficiency to be obtained from their motors. *(Reply to H. V. Harris, Armidale, N.S.W.).*

EIGHT-VOLT MOTORS.—For the time being we are not likely to introduce an 8-volt Hornby motor. We are, however, now considering the introduction of a 6-volt permanent magnet motor of very high efficiency. *(Reply to L. O. Malt, Beckenham, Kent).*

No. '0' TANK ENGINE.—Your suggestion for a new type of 0-4-0 tank engine is quite good, and you will be interested to hear that we are at present considering the introduction of an engine rather similar to the one you have designed. *(Reply to J. H. Baness, Bath).*

THREE-QUARTER RAIL.—The introduction of a three-quarter rail has been suggested on previous occasions. We cannot see what particular advantage such a rail would have over a combination of a half-rail and a quarter-rail. *(Reply to H. M. Darlow, Bedford).*

LARGER RADIUS CURVES.—Your suggestion for curved rails of the same standard radius as the outer rail on our new double track is certainly interesting, and such rails undoubtedly would have advantages. For the time being, however, it is not possible for us to introduce them. *(Reply to J. C. Thomas, Birmingham).*

SMALLER METROPOLITAN LOCOMOTIVE.—We were interested in your proposed "No. 1 Metropolitan" locomotive. A model of this kind would not represent any particular type of engine used on actual railways, however, and for this reason, we do not think it would be popular with the majority of Hornby Train enthusiasts. *(Reply to D. Cole, Belfast).*

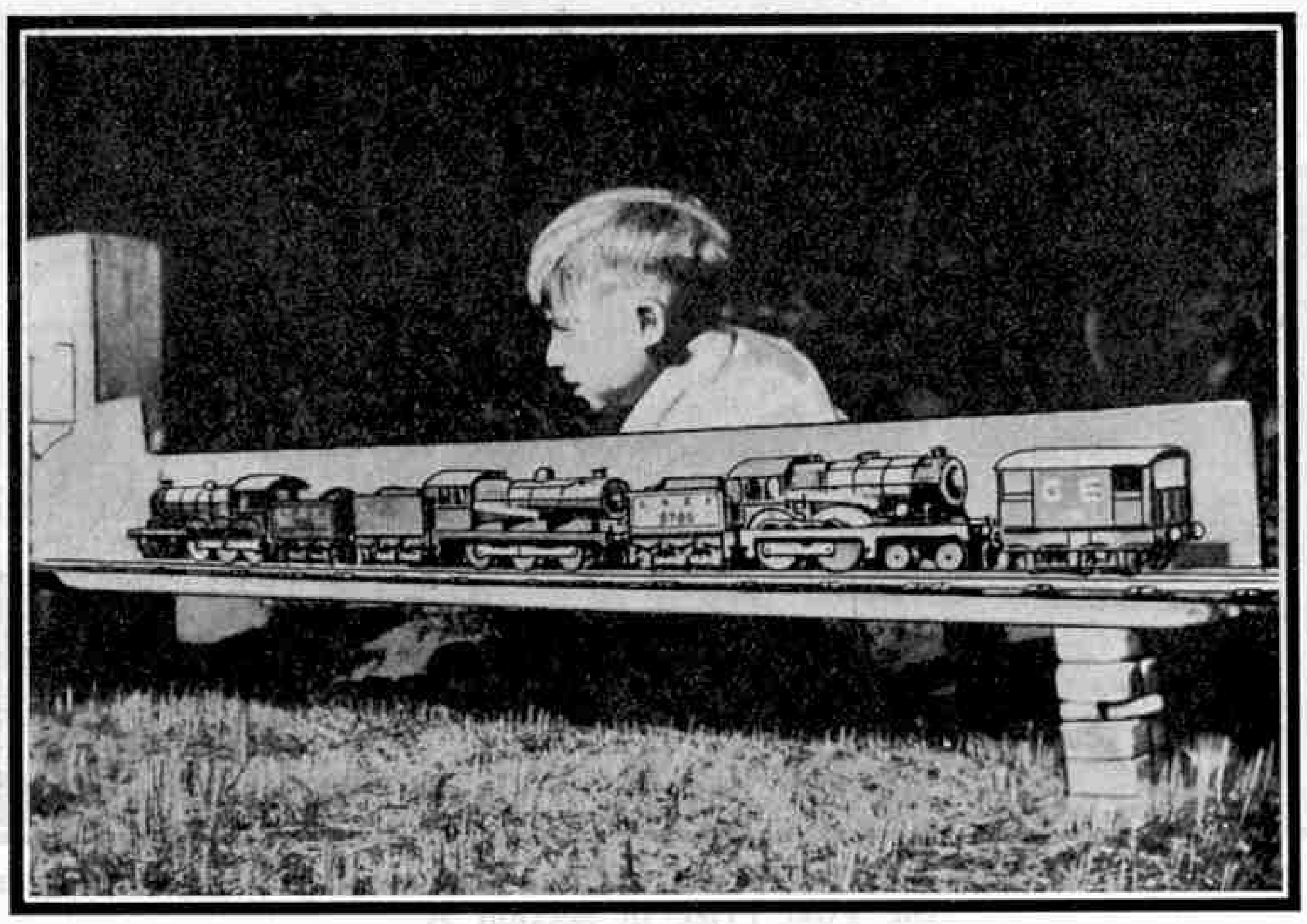
DOUBLE TRACK TUNNELS.—We thank you for your suggestion regarding double track tunnels. We agree that tunnels of this kind would be useful on a Hornby double track layout, and we propose to give the idea consideration. *(Reply to R. Clarke, Berhamstead, Herts.).*

CAST WHEELS.—You can obtain special spoked wheels, suitable for goods wagons, from this office, price 2d. each. Suitable axles also may be obtained, price 3d. per dozen. *(Reply to A. Milligan, Hendon, London, N.W.4).*

NEW CHIMNEY FOR No. 2 LOCOMOTIVES.—We thank you for your suggested design for a new set of chimneys for our No. 2 locomotives. We agree that these are very attractive, and would improve the appearance of the engines in question. You will be interested to hear that we intend to redesign our No. 2 models and when this is done a correct pattern chimney will be fitted. *(Reply to T. R. Williams, Conway).*

HORNBY ANNUAL.—The introduction of a Hornby Annual has been suggested before. We consider that your requirements have already been fulfilled by the Hornby Book of Trains, which both advertises our trains, as you suggest, and also deals with the history and operation of railways. *(Reply to P. J. Welch, Newcastle-on-Tyne).*

TWO-SPEED GEARS FOR LOCOMOTIVES.—We have received quite a number of suggestions and designs for two-speed gears to be fitted to Hornby locomotives. Although the idea is interesting, we are afraid that it is impracticable. *(Reply to J. B. Williams, Manchester).*



Our photograph gives some idea of the excellent results that may be obtained by the use of cardboard in the construction of miniature locomotives. The models were built by Mr. M. B. Flanders of Walthamstow, London, E.17, who is evidently an admirer of the old G.E. design. The model next the 20-ton brake van is a "Super-Claud" 4-4-0 No. 8789, and the other two locomotives represent the standard 0-6-0 goods and "1500" class 4-6-0 passenger types respectively.

No. 1 "NORD" LOCOMOTIVE.—Your suggestion regarding the introduction of a "Nord" goods set, in which would be included a special type No. 1 0-4-0 tender engine painted in "Nord" colours, is an interesting one, although we doubt whether such a set would prove as popular as you imagine. *(Reply to K. Taylor, Middlesbrough).*

1 FT. RADIUS ELECTRIC POINTS.—It is not possible to obtain electric points suitable for use in 1 ft. radius layouts. Up to the present there has been practically no demand for such points. *(Reply to P. Pettifor, London, S.E.3).*

ROTARY TIPPING WAGONS.—We regret to hear that your Rotary Tipping Wagon is liable to overturn when unloading. Possibly you could prevent this by using cast Mansell wheels which are obtainable from this office, price 4d. a pair. As a matter of fact, with ordinary care it should be possible to discharge normal loads from these wagons without making any alteration to their design. *(Reply to J. Jackson, Luton).*

4-6-2 TANK ENGINE.—The introduction of a Tank Engine similar to that you suggest would entail the use of a six-coupled mechanism. As mentioned previously, there is no prospect of our introducing a six-coupled mechanism at present, though we hope to do so at a later date. *(Reply to G. Walton, Leith).*

OVAL-HEADED BUFFERS.—We have experimented carefully with a view to ascertaining whether the addition of oval-headed buffers to Hornby rolling stock would prevent accidents due to buffers interlocking. The results show that little, if any, advantage is to be gained by such buffers, on account of the comparatively sharply curved rails that it is necessary to use on small model railways. *(Reply to N. Chivers, London, S.W.11).*

DOUBLE TRACK BUFFER STOPS.—A double track buffer stop would be a costly item to produce, and as a more realistic result may be obtained by using two stops of the present type, we do not think the introduction would be advisable. *(Reply to H. Kilvington, Bradford).*

ELECTRICALLY FITTED ENGINE SHEDS.—At present we do not supply engine sheds fitted specially for use in conjunction with electric model railways. At a later date, however, we hope to be able to supply sheds similar to the one suggested. *(Reply to Kenneth Key, Paisley, W.).*

FRUIT VANS. — We agree that the introduction of fruit vans would prove quite popular. Your idea will be remembered when we decide to make any additions to the present range of our rolling stock. *(Reply to John Attree, Penarth, Glam.).*

SPECIAL HORNBY-MECCANO RAIL CONNECTIONS.—Your sketch showing a section of rail with holes pierced at one end for attachment to Meccano rails, and a standard Hornby peg and slot at the other end for attachment to Hornby rails is interesting. We agree that it would be possible to connect Hornby rails with those made from standard Meccano parts by means of a rail of this kind. On the other hand, we believe that we are correct in saying that few Hornby enthusiasts use rails made from Meccano to a sufficient extent to warrant our making the introduction that you suggest. *(Reply to R. C. Allison, Reading).*

ELECTRIC DOUBLE TRACK.—At present it is quite impossible for us to consider the introduction of electric double track, but it is very probable that we shall make the addition you suggest later. *(Reply to C. L. Finnis, Dulwich, London, S.E.21).*

DESTINATION BOARDS.—We agree that the realistic effect of a train of Hornby Pullman cars would be increased by the addition of destination boards. One or two enthusiasts have made similar suggestions to yours and we have filed the idea for further consideration later. *(Reply to A. Lulman, Muswell Hill, N.10).*

LAMPS FOR STATIONS.—We think that the present type of Hornby standard lamps ought to satisfy your requirements. It is possible that we shall design a smaller type of lamp at a later date. *(Reply to P. G. Braden, Highgate, London, N.6).*

MODEL FLOWER BEDS.—We hardly think that model flower beds are suitable for introduction into the Hornby Train Series. Such scenic details can be manufactured at home very easily if they are required. *(Reply to Paul Walker, Middlesex).*

SIX-WHEELED BRAKE VAN.—We presume that the brake van you suggest is a goods brake van. We think your idea is interesting, and we are filing it. *(Reply to D. J. Padham, Oxford).*

Results of the Grand £100 Model-Building Contest

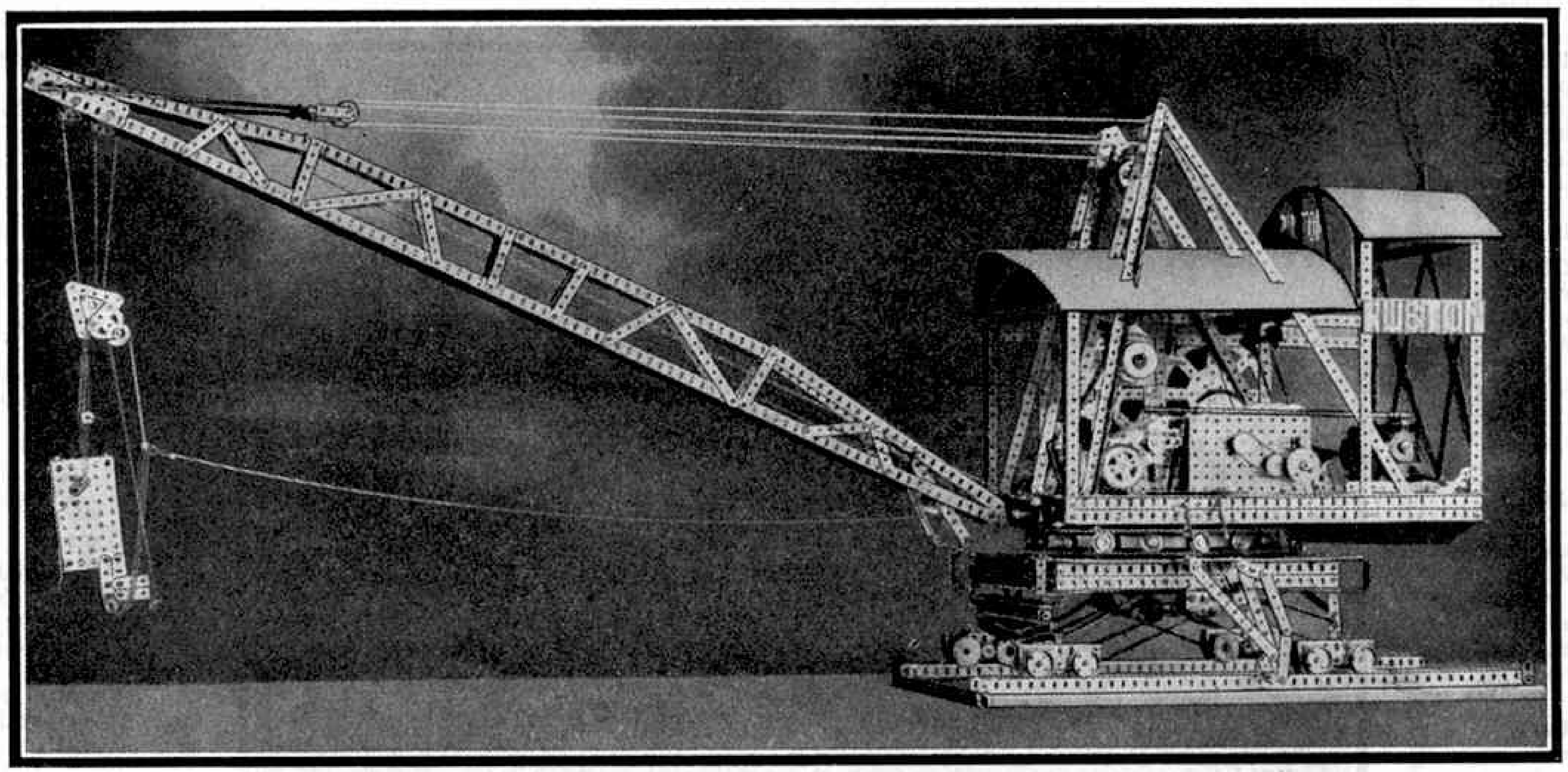
By Frank Hornby

Complete List of Prize-winners in the Home Sections

Every reader of the "*M.M.*," whether he be an active model-builder or not, will be keen to learn the results of the Grand £100 Model-building Contest that was organised last Christmas, and I have therefore much pleasure in publishing a complete list of prize-winners in the three "Home" Sections (A, B, and C) of the Contest. The Overseas Sections are still open (closing date, 31st April, 1929), and the names of the prize-winners in these sections must necessarily appear later.

In a big Contest of this kind a large number of entries would naturally be expected, but I was literally astounded at the quantity and excellence of the models submitted. A remarkable feature of the contest was that several entries of equal merit were submitted in each section, and the judges were compelled therefore to divide the larger awards amongst a number of competitors. It was impossible to pick out any one entry that was definitely superior to the rest.

The large number of awards that have been made in the Contest necessitates that this article be devoted to lists of the names of prize-winners and the prizes that have been alloted to them. It would be a great pity, however, if particulars of some of the more outstanding models were not published for the benefit of all Meccano boys and I therefore intend to illustrate and describe some of them in special articles that will appear from time to time.



A remarkable model Dragline submitted by W. Schofield. This model was tied with four others for the First Prize in Section A

Section A (for competitors over 16 years of age).

The First Prize of £12 has been divided equally amongst the following four competitors, each of whom will receive a cheque for £3: W. D. Schofield, Beaumont Lodge, Lincoln; R. S. Miller, 2, Wellington Road, Newark; A. T. Locke, Primrose Cottage, Shottery, Stratford-on-Avon; Eric Whalley, 20, Beverley Street, Blackburn.

The Second Prize of £8 has been divided equally amongst the following four competitors, who will each receive a cheque for £2: Charles Harrison, 38, Osbourne Road, Blackpool; W. D Priestman, 54, Fountain Street, Hull; C. K. Kernahan, 5, Waterloo Gardens, Belfast; C. P. Plantin, 9, Satarita Road, Westcliff-on-Sea.

The Third Prize of £5 has been divided equally amongst the following four competitors, who will each receive a cheque for £1-5s.: A. A. Mariani, 253, Vauxhall Bridge Road, Victoria, London, S.W.1; Fred Miller, 25, Eric Street, Oldham; Leslie Smith, 29, Ravenscroft Avenue, Golders Green, London, N.W.11; R. J. Banks, Carlton Avenue, Gillingham.

Special Prizes have also been awarded as follows:—

Two Prizes, each consisting of a Complete Meccano Roller Bearing Unit: Richard Michell, Bella Vista, Wilmington, Honiton, Devon; John Redfern, 4, Hough Lane, Lr. Broughton, Salford, Manchester.

Two Prizes, each consisting of a Special Inventor's Outfit: Kenneth Henley, 121, Albury Road, South Merstham, Surrey; Wilfred Horsfield, 36, Preston Street, Darwen, Lancs.

Two Prizes, each consisting of a Meccano 4-volt Motor: L. F. Lacey, 58, Warrior Square, St. Leonards-on-Sea; J. B. Frost, The Beeches, Park Road, Newton-le-Willows, Lancs.

Two Prizes, each consisting of a Meccano Radio Crystal Receiver: T. Myring, Leighswood Road, Aldridge, Near Walsall; Douglas Baker, 41, Beckett Road, Doncaster.

Four Prizes, each consisting of a Meccano Clockwork Motor; R. W. Pearson, Halifax; A. T. Gurney, Kirby Muxloe, near Leicester: Leslie Knill, Harehills, Leeds; Brinley Fussell, Port Talbot.

Twenty Prizes, each consisting of a copy of "Famous Trains," by C. J. Allen (Meccano Library No. 1): W. G. Wilford, Edinburgh; Samuel Dawber, Wigan; John Redding, Bridport, Dorset; C. Randolph Weller, Birmingham; Philip D. Banks, Dunstable; G. D. Coxhead, London, E.11; W. W. Davies, South Tottenham, N.15; Frank Penhall, Shipley; Leslie R. Hollyoak, Earlsdon, Coventry; George Nicoll, Farnham; Claude Palmer, Ramsey, St. Marys; John C. Collins, Goldthorpe; A. G. Thomas, Chadwell Heath; L. H. Turner, Manchester; R. L. Mansi, London, N.1; Herbert Clegg, Bradford; R. J. Thompson, Norwich; C. Garlick, Gatley; V. Smith, Dublin; Leslie Hope, Weston-super-Mare.

Twenty Prizes, each consisting of a copy of a Meccano 4-7 Instruction Manual E. H. Nash, Swindon; G. Effemey, Christchurch; R. S. Weaver, Prestwich, Manchester; W. H. Trenholm, Eaglescliffe; H. Hancock, Welwyn; R. A. Pervanoglu, London, S.E.26; Stanley H. Judson, London, N.W.5; W. Suter, Hadleigh; C. J. Keates, Southsea; Norman Hulbert, Trowbridge; E. Reed, Bridgwater; William Caton, Liverpool; H. M. Sleath, Langwith; V. Staff, Enfield; T. Kennet, Sheerness; James Wilson, Aberdeen; I. I. Pittard, Aberkenfig, near Bridgend; W. Raybould, Walsall, Staffs; C. E. Wrayford, Teigngrace, near Newton Abbot; Cyril Jenkins, Fulham, London, S.W.6.

Twenty Prizes, each consisting of a copy of "Meccano Standard Mechanisms": Stanley Strawbridge, Hucknall, near Nottingham; Fred Truslow, London, E.16, W. Roberts, Mountain Ash, Glam.; G. E. Owen, Bristol; S. F. Farrington, Walsall; Arthur Swann, Stoke, Coventry; Robert Cuffe, Glenageary, Co. Dublin; G. S. Draffen, Aberdeen; A. Poynter, Bradford; W. T. Harriss, London, E.8; G. Weightman, Wembley; George Wood, London, N.19; Archibald G. Wood, West Wickham; Aubrey Smith, Watford; Alan E. Egan, Thirsk, Yorks.; Kenneth Butler, Southport; P. Banham, Norwich, Norfolk; T. Smith, Planklane, Leigh; P. J. Tombleson, E. Croydon; C. Hewkin, Oldham.

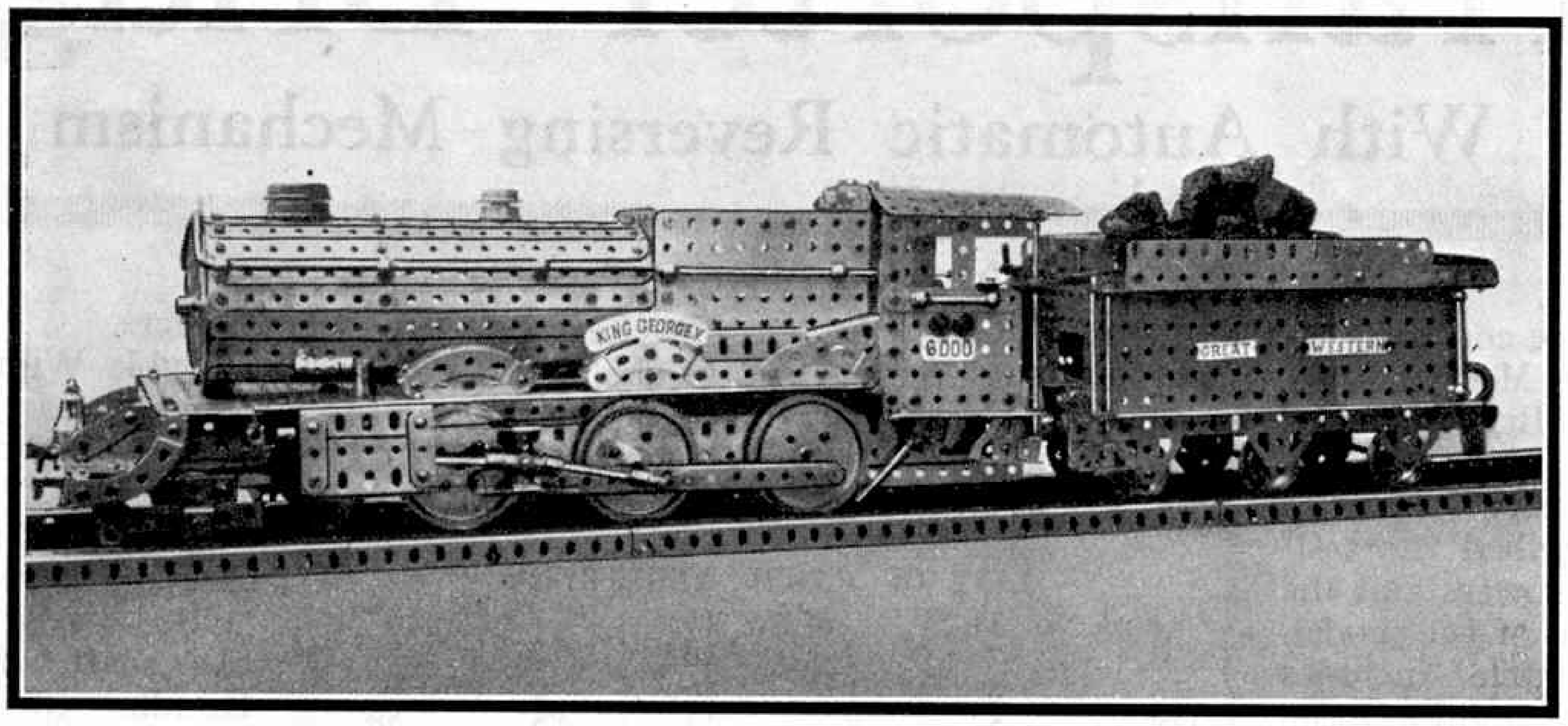
Section B (for competitors over 12 and under 16 years of age).

First Prize, Tie: each competitor will receive a cheque for £4: A. M. Johnston, "Westholme," 198, West Street, Dunstable; R. Kirkham, Clifton Road, Elworth, Sandbach.

Second Prize of £5 divided equally amongst the following four competitors, who will each receive a cheque for £1-5s.: Albert Holmes, 5, Lowther Avenue, Gorton Mount, Gorton, Manchester; T. M. Baskcomb, 35, Weelsby Road, Grimsby;

F. R. Higgs, Revesby, Holmfield Road, Leicester; Eric Roberts, 16, Carlton Road, Southampton.

Third Prize of £3 divided amongst the following three competitors, each of whom will receive a cheque for £1: R. W. Nash, Garage House, Springfield Avenue, Harrogate; Jack Stead, 3, Burton Cottages, Ewhurst Road, Cranleigh; John D. Sephton, 58, Shellfield Road, Marshside, Southport.



A particularly fine example of Model locomotive construction. "*King George V*" built by A. T. Locke

Two Prizes, each consisting of a Special Inventor's Outfit: Charles Holmes, 87, Thoday St., Mill Road, Cambridge; A. T. Wilkinson, "Dewhurst," Rhyswg Road, Abercarn, Mon.

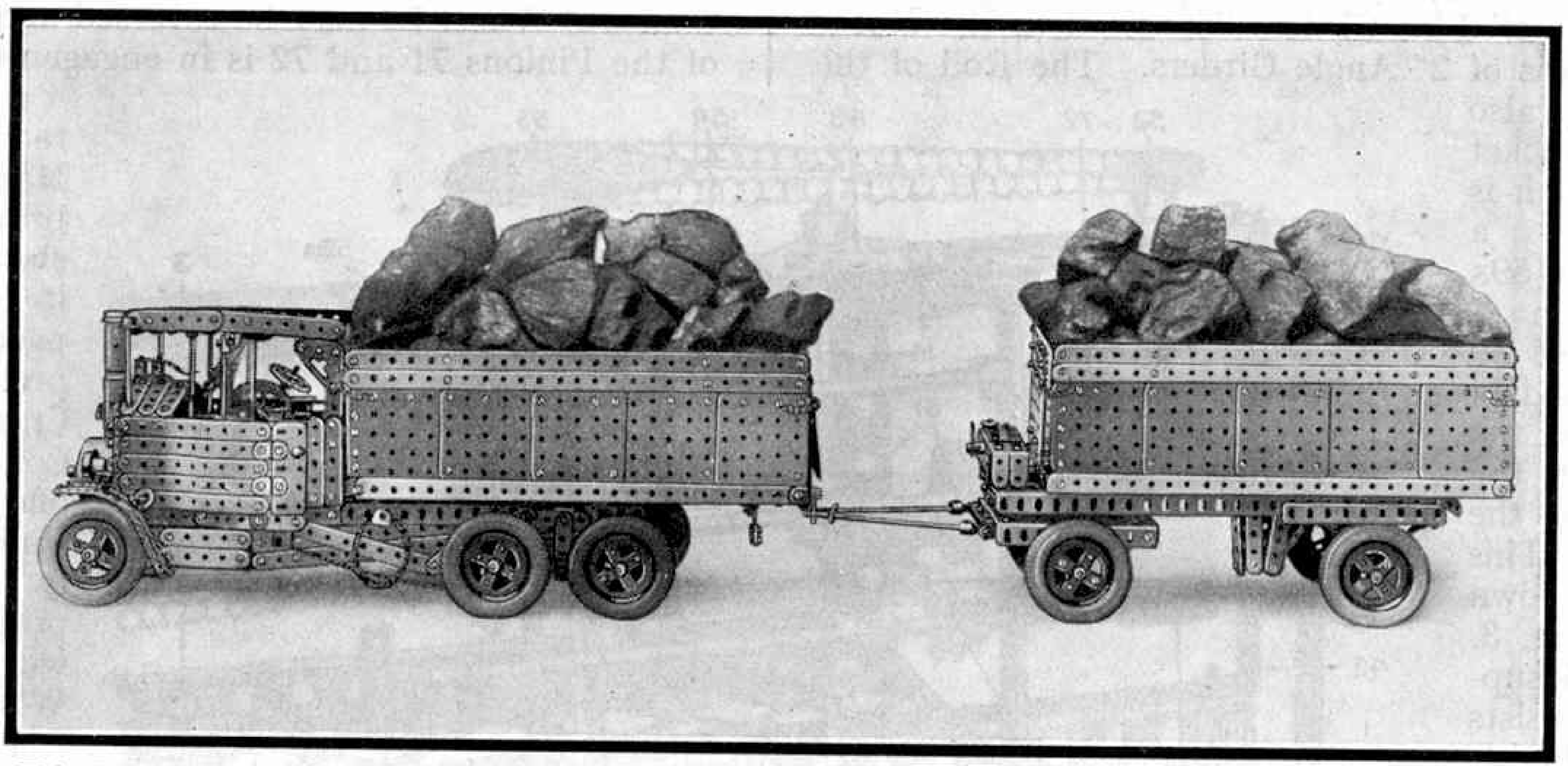
Three Prizes, each consisting of a Meccano Radio Crystal Receiver; J. A. Sizer, 14, Whitworth St., Southcoates Avenue, Hull; M. W. Vaughan-Jackson, The Oaks, Cross Oak Road, Berkhamsted; William E. Baker, 45, The Mall, Swindon.

Four Prizes, each consisting of a pair of Meccano Headphones · E. P. Rudkin, 145, Harlaxton Road, Grantham; Albert Blackburn, High Street, Kelvedon; R. M. Horton, 34, Albert Road, Ashford; M. C. Jones, 1, Netherfield Gardens, Barking, Essex.

Four Prizes, each consisting of a Meccano Clockwork Motor: R. B. G. Fletcher, Walthamstow, London, E.17; K. S. Oliver, Brighton; Mathew Hellens, Minehead; L. M. Allen, Pangbourne.

Four Prizes, each consisting of a Meccano Oil Can No. 2 (K Type): J. R. C. Elliot, Strabane, Co. Tyrone; H. G. Newstead, Wembley Park; Kenneth Mackenzie, Belfast; P. Brocklehurst, Chester.

Twenty Prizes, each consisting of a copy of "Famous Trains," by C. J. Allen (Meccano Library No. 1): Cyril Walker, Nottingham; A. Middlemass, Falkirk; G. Kenneth Holland, Liverpool; Stanley Marshall, Seven Kings; Raymond G. Chappell, Manchester; W. A. Lavers, St. Leonards-on-Sea; Alexander McGregor, Wallsend-on-Tyne: Stanley J. Cook, London, S.W.6; E. B. Dobson, Chelmsford; Dennis R. Brooker, London, S.W.6; J. W. Stott, Hull; James McNeil, Omagh, Co. Tyrone; F. H. Churchill, London, N. 14; C. Playford. Uxbridge; H. J. Willie, Southsea; S. L. Phillips, Ware; H. R. Webb, Haverhill; Edgar Whatley, New Moston, Manchester; J. W. Sullivan, Reading; R. Holloway, Southampton.



This Steam Wagon and Trailer was entered by R. Kirkham, and shared the First Prize in Section B. The realistic appearance of the model will be noted

Thirty Prizes, each consisting of a copy of "Meccano Standard Mechanisms": J. C. Kilner, Honley, near Huddersfield; Kenneth Rushton, London, S.E.24; R. H. V. Spalding, Lerwick, Shetland; A. D. Monkhouse, Harpenden; J. W. Reid, Birmingham; Alex Robert Philip, Angus; W. S. Austin, London, S.E.17; James A. Knowles, Arbroath; Douglas Hale, Farnham; J. Wilson, Worcester; Brian Pigott, Wallasey; Robert Emsley, Bradford; H. J. C. Sayer, London, S.E.24; L. D. Smart, Kingston-on-Thames; Robert Meek, Rutherglen; W. F. F. Kemsley, Folkestone; R. M. Loewy, London, N.W.2; I. R. Carrick, Bridlington; F. A. Lyne, Littledean, Glos.; E. White, Widnes; B. Stuart, Armagh; R. J. Robertson, Glasgow, E.1; W. B. Hodgson, Bromley, Kent; G. Chesterfield, Alton, Hants.; R. L. Brooks, London, S.W.17; F. G. Swift, Great Crosby, Liverpool; D. Kallenborn, Eltham, S.E.9; D. P. Edkins, Accrington; W. Dobson, Glasgow; H. Bowman, Wanstead, E.11.

Section C (for competitors under 12 years of age).

First Prize, Tie: each competitor will receive a cheque for £2-10s.: R. F. Harris, 4, Suffolk Mansions, Suffolk Square, Cheltenham; John A. Rodrigeuz, 83, Biddulph Mansions, Maida Vale, London, W. 9.

Second Prize, Tie: each competitor will receive a cheque for £1-10s.: Peter Fontaine, 5, Blenheim Road, Bedford Park, London, W.4; E. P. Hicks, 90, Station Road, Billquay, Pelaw-on-Tyne.

Third Prize, Tie: each competitor will receive a cheque for £1: Graham Hawes, Ivanhoe, Church Avenue, Farnborough; G. P. Neilan, New Seaham, S.O., Co. Durham.

Two Prizes, each consisting of Meccano No. 2 Outfit: Samuel J. Morrison, 86, Fernleigh Road, Newlands, Glasgow; R. D. Plowman, Shynewood, Chase Green Avenue, Enfield.

Prize consisting of a Meccano No. 1 4-volt Electric Motor: S. D. King, 66, Sir Harry's Road, Edgbaston, Birmingham.

Prize consisting of a Hornby M3 Goods Set: H. F. Mann, 20, Somerset Road, Erdington, Birmingham.

Three Prizes, each consisting of a Meccano Clockwork Motor: Herbert Murray, 7, Trinity Crescent, Leith; F. A. E. Hanson, 31, Suffolk Road, Milton, Portsmouth; Neville B. Roberts, 9, Parkhill Street, Dudley, Worcs.

Two Prizes, each consisting of an M1 Hornby Train Set: R. N. Harrison, 6, Berkeley View, Harehills, Leeds; M. G. Thomas, "Stranraer," Eugene Road, Paignton.

Twelve Prizes, each consisting of a copy of "Famous Trains" by C. J. Allen (Meccano Library No. 1): Raymond Coldman, London, S.W.; David H. Caulkin, Solihull; S. Furniss, Blackpool; F. J. H. Tingey, New Barking; Dick Temple, Leigh-on-Sea; Eric G. Mounsey, Hemel Hempstead; Walter Knight Coupar, Dundee; R. Keith Taylor, Blackpool; F. S. Shepherd, Grantham; Norman Pullen, London, S.W.16; R. Wright Whittorne, Ramsey, Hunts.; N. H. D. Winder, Liverpool.

Six Prizes, each consisting of a 00-3 Manual: William Ford, Bristol; Joseph R. Leech, Sandiway; F. H. Collins, Manchester; R. Hartog, London, W.11; Edward Kung, London, W.9; Philip J. Stone, Bournemouth.

Twenty-Five Prizes, each consisting of a copy of the Standard Mechanism Manual: Frank Manning, Wellingborough; Robert Ward, Southend-on-Sea; Cyril Lorkin, Rochester; Arthur Lobb, Bodmin; C. Vicary, Aberdare; Leslie Speakman, Stratford, E.15; George Lewis, Bracknell; Kenneth Hall, Birmingham; John Murdoch, Brighton; John Edward Thould, Dursley; Stacey D. Jones, West Bromwich; John R. Boddy, Darlington; Joseph Peacock, Reading; J. C. E. Peshall, Portsmouth; Jack Smith, Eastleigh; Kenneth E. Atherton, Bristol; John A. Clark, Seven Kings; F. P. Stainthorp, Liverpool; William Wilson, Birmingham; A. Macleod, Clevedon, Somerset; Russell Herbert, Ipswich, Suffolk; E. Kerman, Hull; John D. Sewill, Southend-on-Sea; Alan Frederick Haines, Swansea; Ralph Worland, Cleethorpes, Lincs.

New Meccano Model:

Transporter Bridge

With Automatic Reversing Mechanism

(Concluded from last month)

THIS month we conclude the detailed instructions for building the Meccano model Automatic Reversing Transporter Bridge. In the March issue of the "*M.M.*" we explained the purpose and general principles of the "transporter" type of bridge, and described the construction of the towers and the main bridge span of the model. The present article includes instructions for building the travelling carriage and for assembling the mechanism controlling its movement. In reading the article it should be remembered that Figs. 1 and 2 appeared in the March "*M.M.*"

LIST OF PARTS REQUIRED :

4 of No. 1B	2 of No. 15A	2 of No. 52
8 ,, ,, 2	3 ,, ,, 16A	2 ,, ,, 52A
18 ,, ,, 3	1 ,, ,, 16B	4 ,, ,, 53
112 ,, ,, 5	2 ,, ,, 17	28 ,, ,, 59
14 ,, ,, 6	4 ,, ,, 18A	2 ,, ,, 62
6 ,, ,, 6A	1 ,, ,, 19	7 ,, ,, 63
10 ,, ,, 7	4 ,, ,, 20B	4 ,, ,, 70
26 ,, ,, 8	4 ,, ,, 22	10 ft. ,, ,, 94
10 ,, ,, 8A	4 ,, ,, 23A	1 ,, ,, 95
4 ,, ,, 8B	1 ,, ,, 25A	2 ,, ,, 96
22 ,, ,, 9	3 ,, ,, 26	3 ,, ,, 96A
8 ,, ,, 9A	1 ,, ,, 27	6 ,, ,, 99
4 ,, ,, 9B	1 ,, ,, 29	2 ,, ,, 99A
4 ,, ,, 9D	1 ,, ,, 32	6 ,, ,,100
2 ,, ,, 9E	26 ,, ,, 35	20 ,, ,,101
6 ,, ,, 10	507 ,, ,, 37	2 ,, ,,103G
6 ,, ,, 11	162 ,, ,, 38	2 ,, ,,103K
22 ,, ,, 12	8 ,, ,, 40	4 ,, ,,108
1 ,, ,, 12A	1 ,, ,, 43	2 ,, ,,115
8 ,, ,, 12B	2 ,, ,, 45	4 ,, ,,126A
3 ,, ,, 13	4 ,, ,, 48	4 ,, ,,136
3 ,, ,, 13A	17 ,, ,, 48A	2 ,, ,,165
2 ,, ,, 14	3 ,, ,, 48B	1 Electric
4 ,, ,, 15	3 ,, ,, 48C	Motor

The Operating Mechanism

The driving power is obtained from a Meccano Electric Motor, which may be of either the 4-volt or the high voltage type. The Motor is mounted on the platform 16 of one of the end towers as shown in Fig. 2 (see March "*M.M.*").

The armature spindle of the Motor carries a Worm 38 engaging the Pinion 37, which is mounted on a Rod that is journalled in 2″ Flat Girders 35 bolted to the Motor casing by means of 2″ Angle Girders. The Rod of the Pinion 37 also carries a ¾″ Sprocket Wheel 36, which is connected by a Sprocket Chain 59A (Fig. 3) with a ¾″ Sprocket Wheel 59 carried on a Rod 54 incorporated in the mechanism at the driving end of the main span. This mechanism is shown in detail in Fig. 3. The framework supporting it consists of 4½″ × ½″ Double Angle Strips 41 connected at their ends to 5½″ and 3½″ Strips overlapped three holes and bolted together. The framework is supported from the Angle Girders 3 of the main span by short Strips and 1″ × ½″ Angle Brackets bolted to the Girders.

The Rod 54 carries a Double Width Pinion 57 that engages with a 50-teeth Gear 58 carried on the end of the Rod 50, on the other end of which are two ½″ Pinions 71 and 72. The Rod 50 is slidable in its bearings, the sliding movement being controlled by a Crank secured to the shaft of the 5½″ Crank Handle 46 and carrying a Threaded Pin to which is secured a Collar 75. The arm of the Crank engages between two 1″ Pulleys carried on the Rod 50, while the Collar 75 engages between two ½″ Pulleys 66 carried on a Rod 49 that is slidable in its bearings.

On the inner end of the Rod 49 is a 1″ Pulley 74. By pushing or pulling this Pulley the Rod 49 and the Crank are moved and the latter transmits movement to the Rod 50, thus bringing one or other of the Pinions 71 and 72 into engagement with the Contrate Wheel 73. It will be seen from Fig. 3 that by this means the direction of rotation of the Contrate Wheel 73 may be reversed according to which of the Pinions 71 and 72 is in engagement.

A Spring 48 attached to the Crank Handle tends to bring the latter over sharply so soon as it has been moved past its "critical" position by the Crank carrying the Collar 75. Hence one or other of the Pinions 71 and 72 is always held properly in mesh with the Contrate Wheel.

The Crank Handle 46 is journalled in Flat Trunnions 45 and carries a Coupling 68 in which is secured a 2″ Rod carrying a Swivel Bearing 65. This is

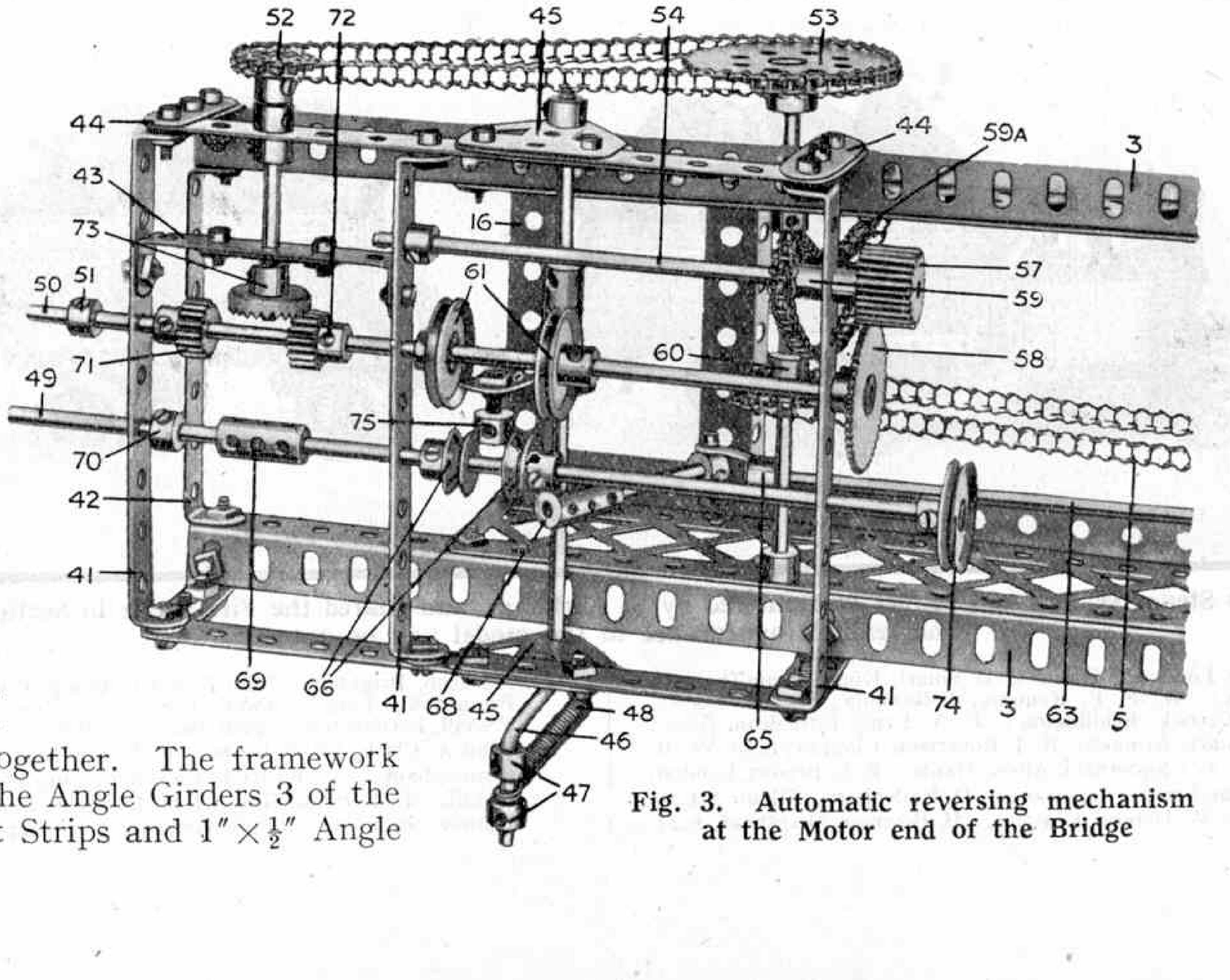


Fig. 3. Automatic reversing mechanism at the Motor end of the Bridge

connected with Rod 63 (three 11½″ and one 8″ Rods coupled together) which runs the length of the main span and connects up with the mechanism at the other end of the bridge.

The final drive to the car is taken from the ¾″ Sprocket 52 (Fig. 3) carried on the Rod of the Contrate Wheel 73. This Rod is journalled in a Double Angle Strip 43 and the Strip of the frame as shown. The Sprocket Wheel 52 drives a 2″ Sprocket 53 on a Rod that is journalled in the Angle Girders 3. This Rod also carries a 1″ Sprocket 60 round which passes an 80″ endless length of Sprocket Chain 5 (see also Fig. 1) that carries a 1½″ Strip 96 (Fig. 4) and runs the whole length of the main span to the other tower, where it passes round a 1″ Sprocket 97 (Fig. 4) secured to a Rod 92 journalled in the Angle Girders 3. The purpose of the Strip 96 will be explained later, together with an explanation of the operation of the mechanism.

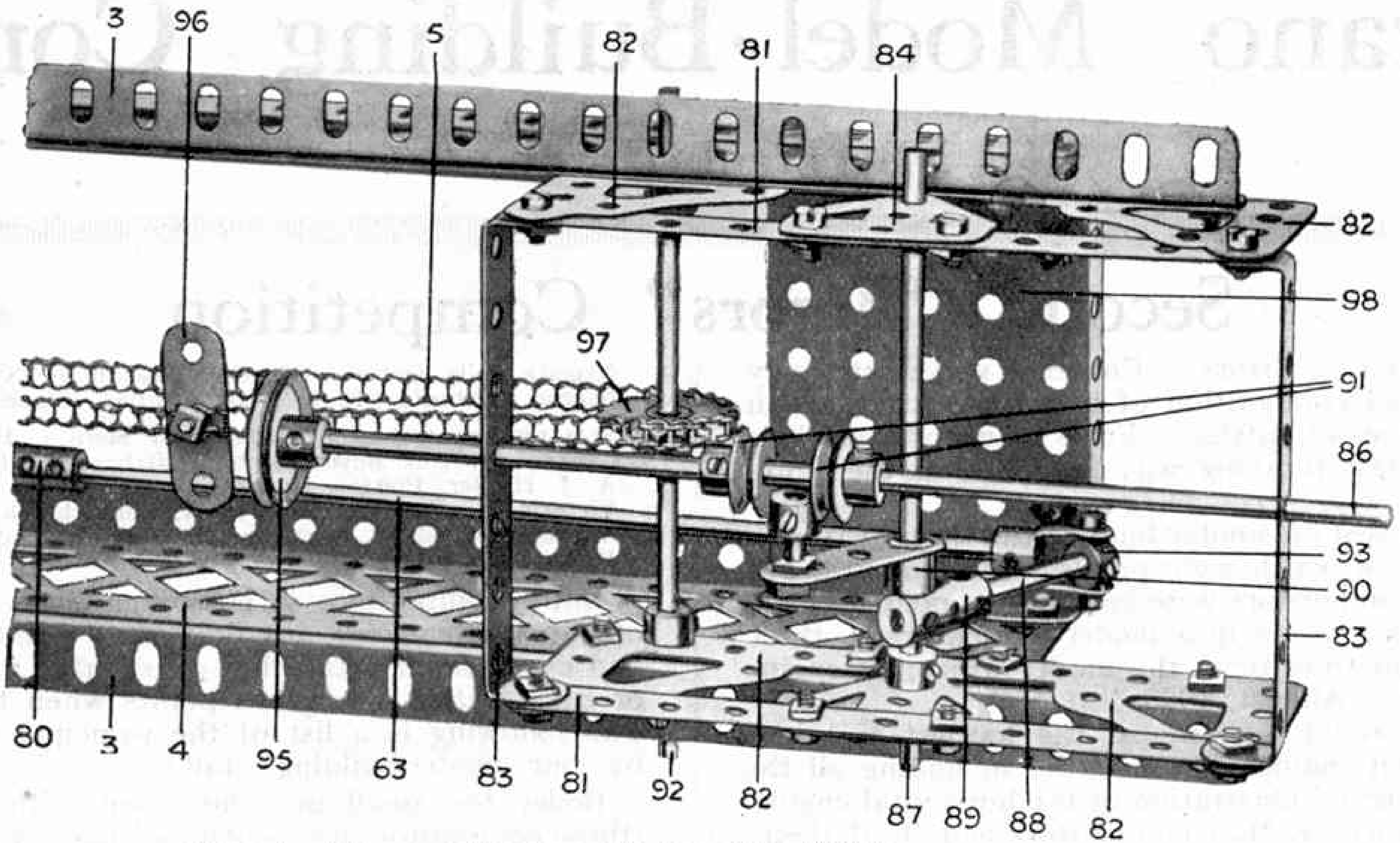


Fig. 4. The mechanism at the non-Motor end of the Bridge

Mechanism at the Non-Motor End

This is shown in Fig. 4. The framework that supports the Rods of the mechanism is constructed from 3½″×½″ Double Angle Strips 83, to which are bolted 5½″ Strips 81. The frame thus formed is attached to the Girders 3 of the main span by Architraves 82.

A Rod 87 journalled in Flat Trunnions 84 carries a Crank 90, in the end of which is a Threaded Pin carrying a Collar that engages between two ½″ Pulleys 91. These are secured about ½″ apart on the Rod 86, which also carries at its inner end a 1″ Pulley 95. A Coupling 89 secured to the Rod 87 carries a 2″ Rod 88, on the end of which is fastened the collar of a Swivel Bearing 93. It will now be seen that by pushing the Pulley 95 the Crank 90 will be actuated and in turn will operate the Rod 63 through the Coupling and Rod 88.

Details of the Travelling Carriage

The travelling carriage, or "transporter," is shown in Fig. 5. The rectangular framework carrying the Wheels 22 (¾″ Flanged Wheels) is built up from two 5½″ Angle Girders 6 bolted to 7½″ Flat Girders 20 that carry Flat Brackets to which are bolted 7½″ Strips 21. The travelling wheels 22 are secured to 1½″ Rods journalled in the Flat Girders 20 and in the Strips 23. Two Double Bent Strips 24 are bolted to the Angle Girders 6; the purpose of these will be explained later.

The carriage proper is suspended from the trolley by means of the Loom Healds 26 attached to the Rods 99 and 27, and spaced apart by Spring Clips. The carriage is composed of Flanged Plates 30 to which are secured 5½″ Braced Girders 28. The Girders 28 carry Angle Brackets 31 in the holes of which are journalled the 5″ Rods 27.

After the carriage and trolley have been constructed the whole unit may be placed in position on the main span of the bridge. To do this it will be necessary to remove one side of the trolley in order to set the travelling wheels 22 to run on the flanges of the Girders 3 (Fig. 1). When the trolley is in position two Angle Brackets 25 (Fig. 5) may be placed as shown so that they bear against the under surfaces of the Angle Girders 3 and thus prevent the trolley being lifted from the rails.

The Sprocket Chain 5 (Figs. 1, 3 and 4) may now be passed round the Sprocket 97 (Fig. 4), thence through the Double Bent Strips 24 (Fig. 5) secured to the trolley, and round the Sprocket 60 (Fig. 3). The 1½″ Strip 96 (Fig. 4) must be secured to the Chain 5 in a position between the Double Bent Strips 24 so that as the Chain moves along, the Strip 96 bears against one or other of the Double Bent Strips, with the result that the carriage is moved along also. The Chain itself is not actually secured in any way to the trolley.

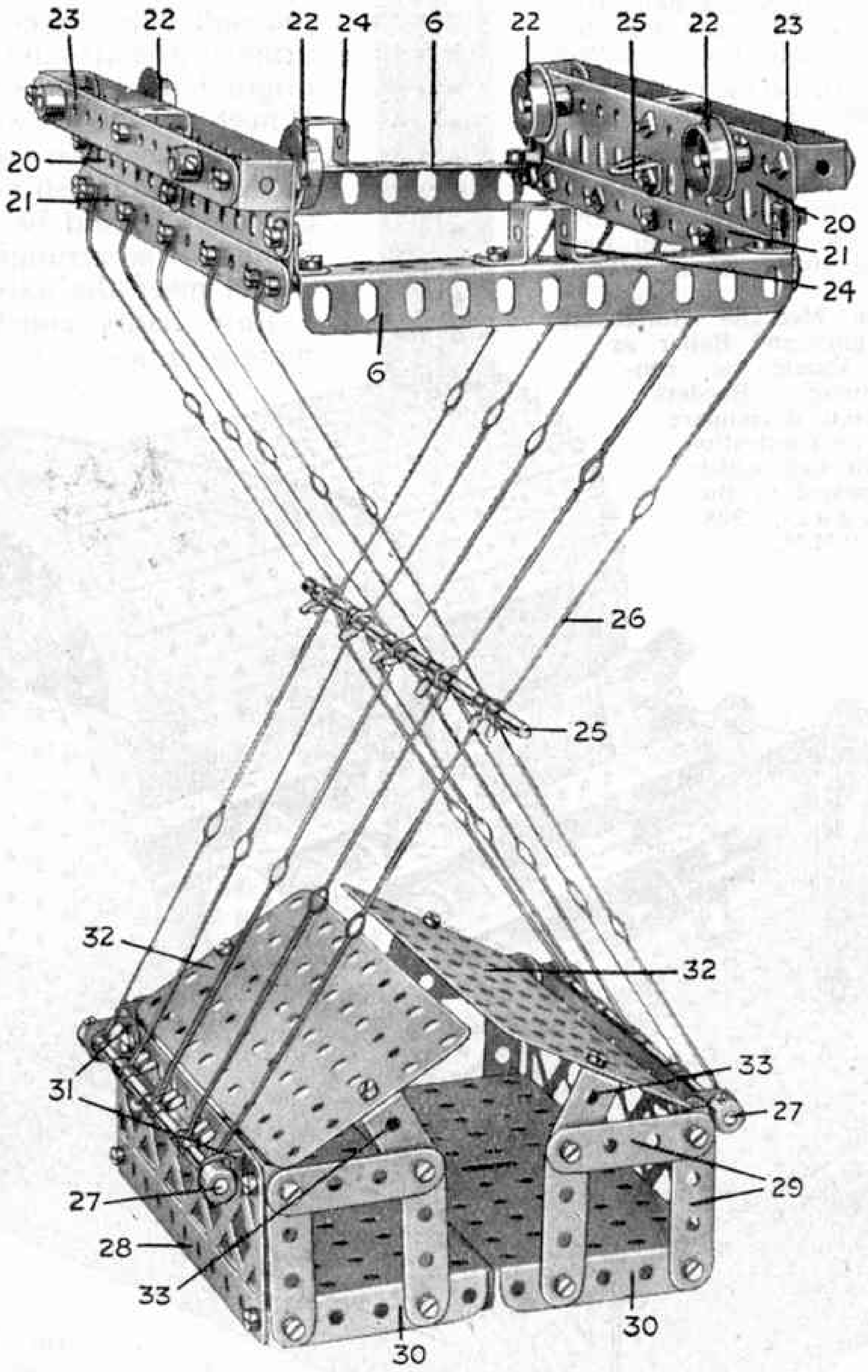


Fig. 5. The overhead Trolley, with suspended Carriage

Action of the Automatic Reversing Gear

When the carriage 30 (Fig. 1) moving to the left strikes the Pulley 74 (Figs. 1 and 3), of the reversing gear, the Crank 75 on the Crank Handle 46 is moved round until the Spring 48 on the Crank Handle pulls the latter hard over. In doing so, however, the end of the Crank (*Continued on page 303*)

Results of
Meccano Model-Building Contests

By Frank Hornby

Second "Errors" Competition

ALTHOUGH the first "Errors" Contest was extremely popular the second competition of this type attracted an even greater number of entries. From many of these it is obvious that much earnest thinking was expended in their preparation!

The contest was organised on similar lines to the first "Errors" Competition, the results of which were published last month, but while in the latter the competitors were required to point out the faults in construction and design in a model derrick crane, those entering this contest had to criticise the model horizontal engine that was illustrated in the August, 1928, *"M.M."*

The second contest provided, perhaps, the hardest task, for some knowledge of steam engines was essential in finding all the faults included in the original illustration of the horizontal engine. I am pleased to say, however, that competitors acquitted themselves remarkably well. Those who are able should turn to page 685 of the August, 1928, *"M.M."* and compare the model shown therein with the correctly built one illustrated on this page. The contrast between the two models will then be noted!

The prizes have been awarded in the various Sections as follows:—

Section A (for competitors over 14 years of age).

FIRST PRIZE (Meccano products to value £3-3s.): John E. Hewkin, Chiswick, London, W.4. SECOND PRIZE (Meccano products to value £2-2s.): Herbert Caddy, Thetford, Norfolk. THIRD PRIZE (Meccano products to value £1-1s.): John V. McGann, Fermoy, Co. Cork.

SIX PRIZES, each consisting of a Meccano Crystal Set or Meccano Products to value 10/6: Henry L. McMillan, Shrewsbury; F. A. D. Sadler, Four Oaks, Warwickshire; R. J. Banks, Gillingham, Kent; J. R. Grimsdell, Finchley, London, N.3; Dennis M. Gill, Doncaster; W. L. Williams, London, S.W.5.

SPECIALLY COMMENDED (Certificate of Merit): Stuart D. Taylor, Crouch End, London, N.8; W. McGuffin, Drogheda, Co. Louth; Ernest W. Luxton Plymouth.

Section B (for competitors under 14 years of age).

FIRST PRIZE (Meccano products to value £2-2s.): W. C. Roberts, Hove. SECOND PRIZE (Meccano products to value £1-1s.): A. R. D. Robson, Eastbourne. THIRD PRIZE (Meccano products to value 10/6): N. S. Graeme, Fleet, Hants.

SIX PRIZES, each consisting of a complete copy of the Meccano Manual: W. B. Williams, Acle, near Norwich, Norfolk; R. Jarrett, Ettington, near Stratford-on-Avon; H. Thistlethwaite, Barnard Castle, Co. Durham; John Jacques, Chippenham; B. H. Moloney, Cheltenham; Bernard A. J. Brockwell, Kingston Hill.

SPECIALLY COMMENDED (Certificate of Merit): Derwent Mercer, Woking; G. D. Frankland, Menston-in-Wharfedale; B. Madeley, Manchester; Ronald R. Brown, Norwich; F. Mackay, London, W.6.

Section C (Overseas competitors).

FIRST PRIZE (Meccano products to value £3-3s.): A. Saunders, Hamilton, New Zealand. SECOND PRIZE (Meccano products to value £2-2s.): Alan Brown, Wanganui, New Zealand. THIRD PRIZE (Meccano products to value £1-1s.): Lou Packard, Lachine, Quebec, Canada.

SIX PRIZES, each consisting of a Meccano Crystal Set or Meccano products to value 10/6: H. Sturtevant, Newcastle, N.S.W., Australia; George Mann, Dunollie, New Zealand; G. W. Gillbe, Port Elizabeth S. Africa; James Nelson Niagara Falls, Ontario, Canada; Graham R. Nisbet, Mont Albert, E.10, Melbourne, Australia ;] E. T. Myers, Pontiac, Illinois, U.S.A.

SPECIALLY COMMENDED (Certificate of Merit): Hugh Bibby, Flesherton, Ont., Canada; J. A. N. Beyers, Pietermaritzburg, S. Africa; R. Singh, Lahore, India; A. J. Hunter, Preston, Victoria, Australia; L. G. Williams, Footscray, W.11, Victoria, Australia; R. O. Jukes, Christchurch, New Zealand; L. P. Koch, Yorkes Peninsula, S. Australia; W. G. Epps, Sydney, Australia; Jack Gunther, Durban, Natal, S. Africa.

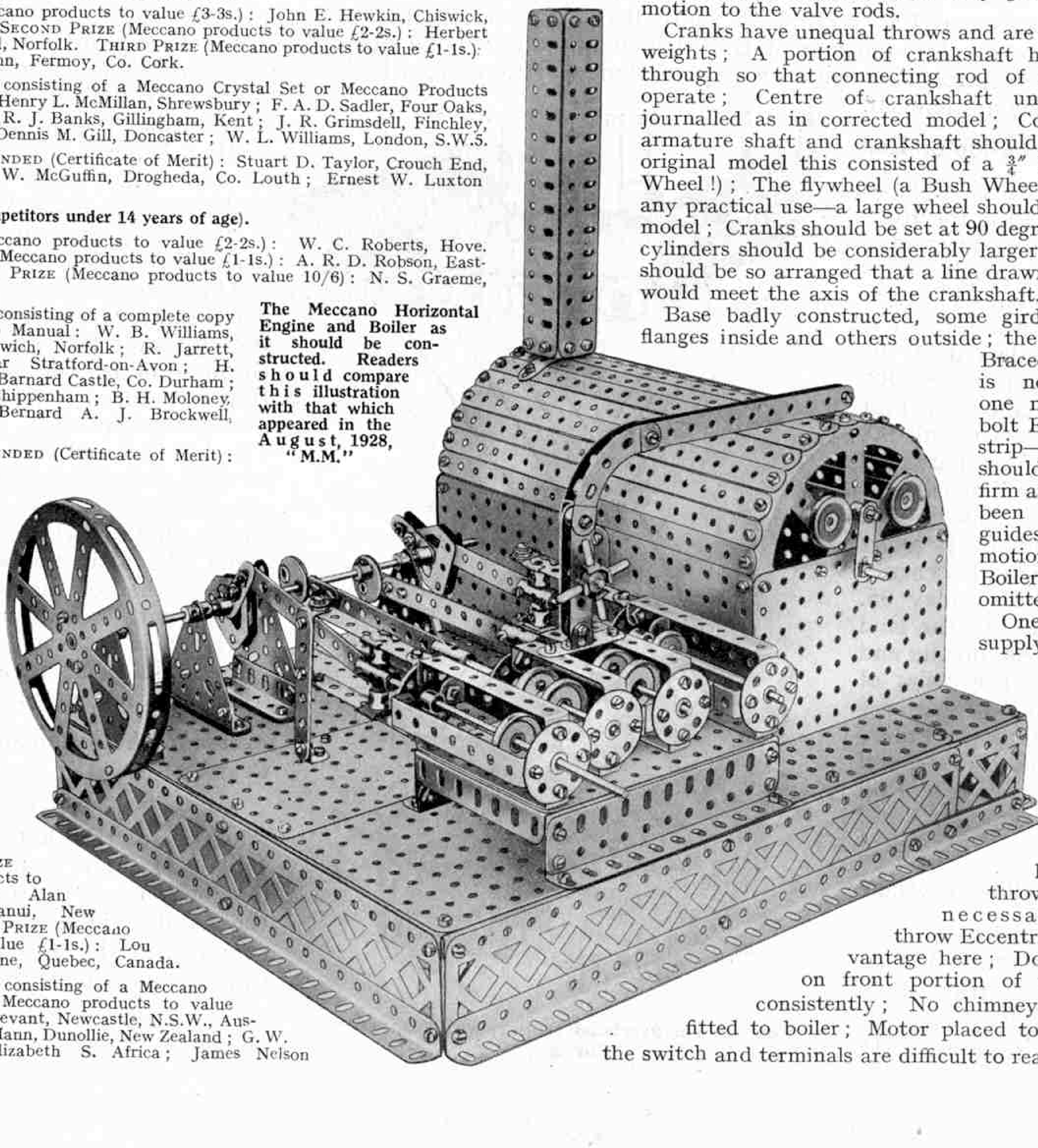
Many competitors in compiling their lists suggested a number of minor alterations, in addition to pointing out the chief errors, and every small detail that constituted an improvement in design or construction was given points when the prizes were awarded. The following is a list of the principal errors deliberately made by our model-building staff:—

Boiler too small in comparison with other details of engine (those competitors who suggested placing the Electric Motor inside the boiler framework were awarded extra points); Steam pipe branches lead to one cylinder and one valve chest—they should both lead to valve chests; Throttle valve controls steam to one cylinder only; Crosshead guides unsupported at front end; Connecting rods of different lengths; Valve rods too long; Eccentrics arranged so that they give unequal longitudinal motion to the valve rods.

Cranks have unequal throws and are not fitted with balance weights; A portion of crankshaft has been carried right through so that connecting rod of front cylinder cannot operate; Centre of crankshaft unsupported—should be journalled as in corrected model; Correct gearing between armature shaft and crankshaft should be introduced (in the original model this consisted of a ¾″ Pinion and 1½″ Pulley Wheel!); The flywheel (a Bush Wheel) is too small to be of any practical use—a large wheel should be fitted as in revised model; Cranks should be set at 90 degrees to each other; The cylinders should be considerably larger than valve chests and should be so arranged that a line drawn through their centres would meet the axis of the crankshaft.

Base badly constructed, some girders being shown with flanges inside and others outside; the method of joining the Braced Girders at the corners is not consistent; Only one nut and bolt used to bolt Eccentric to connecting strip—two nuts and bolts should be used to ensure a firm attachment; A bolt has been placed in crosshead guides which would prevent motion of the crosshead; Boiler supports and firebox omitted.

One branch pipe from main supply pipe is not secured at lower end; The construction of valves and cylinders is inconsistent; Eccentrics should be set at 180 degrees to each other; The piston valves should be longer; The Triple-throw Eccentrics are unnecessarily clumsy—Single-throw Eccentrics could be used to advantage here; Double-arm Cranks used on front portion of crankshaft placed inconsistently; No chimney or flue of any kind fitted to boiler; Motor placed too near boiler, so that the switch and terminals are difficult to reach.



The Meccano Horizontal Engine and Boiler as it should be constructed. Readers should compare this illustration with that which appeared in the August, 1928, "M.M."

"September" Competition, Home Sections

THE fine collection of models illustrated below will give the reader some idea of the excellence of the entries that were received in this contest. The prizes have been awarded in the Home Sections as follows:—

Section A (**for competitors over 14 years of age**).

First Prize (cheque to the value of £3-3s.): Eric Campbell, Castledermot, Co. Kildare. Second Prize (cheque to the value of £2-2s.): Miss A. M. Tyler, Bognor, Sussex. Third Prize (Tie; each competitor will receive cheque to value £1-1-0); G. N. Rhodes, Preston, Lancs.; K. W. Cameron, Oxton, Birkenhead.

Six Prizes, each consisting of Meccano Double Headphones: John Redfern, Salford, Manchester; C. B. Coles, London, W.14; Jack Barr, Aberdeen; E. H. Bradshaw, Sheffield; R. J. Thompson, Norwich; R. Adamson, Acomb, York.

Twelve Prizes, each consisting of a Meccano Single Telephone Receiver: A. E. Hill, Irlam; L. Williams, Ramsgate; L. Lacey, St. Leonards-on-Sea; Frank N. Goodman, London, S.E.4; W. H. Trenholm, Eaglescliffe; Victor Thompson, Woodhall Spa; A. Hoboken, Finchampstead, Berks.; N. E. Sharp, Loughton; John F. Hady, Ilford; A. J. Sibley, Sherborne; James Wilson, Aberdeen; S. Gray, Edinburgh.

Specially Commended (Certificate of Merit): L. Hollyoak, Coventry; A. B. Martin, Bristol; James Noble, Openshaw, Manchester; W. D. Burgess, Stafford; V. F. Barbosa, Stroud; R. F. Newton, London, E.5; Jack Fox, Bradford, Yorks.; Clement Bishop, Wybunbury, near Nantwich; E. Whatley, Failsworth, Manchester; Dick Field, Cirencester; J. W. Hunt, Belper, Derbyshire; "Inventicus," London, N.W.10.

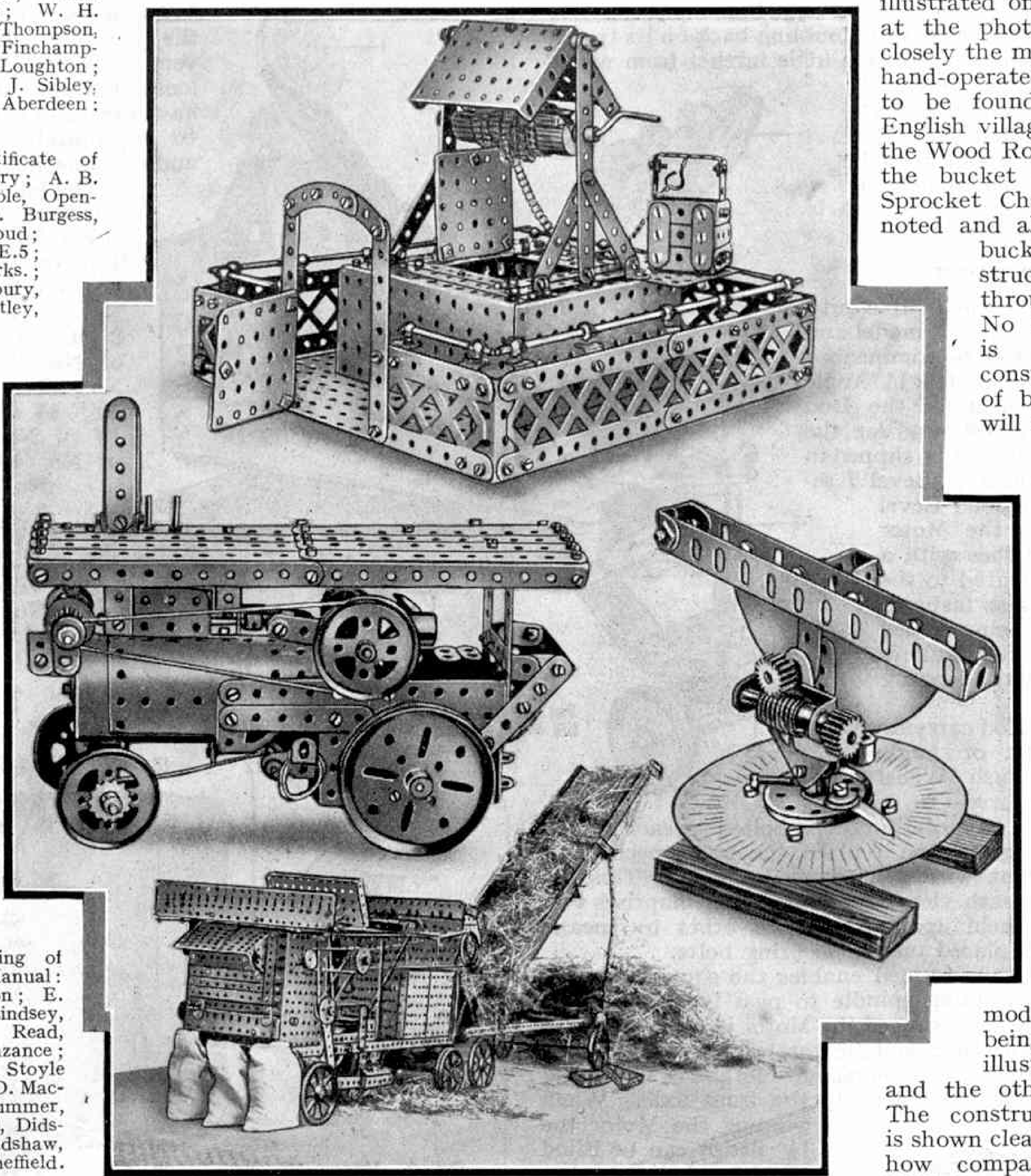
Section B (**for competitors under 14 years of age**).

First Prize (Meccano products to the value of £2-2s.): Cyril Walker, Nottingham. Second Prize (Meccano products to the value of £1-1s.): R. J. Whitney, Birmingham. Third Prize (Meccano Double Headphones or Meccano Crystal Receiving Set): Michael H. Maufe, Ilkley.

Six Prizes, each consisting of Meccano Single Telephone Receivers: W. J. Paxman, Ashford; Kenneth Wood, Huddersfield; Ronald Smith, London, W.C.1; A. J. Williams, Grimsby, Lincs.; Robert D. Myles, Wylde Green, near Birmingham; A. Middlemass, Falkirk.

Twelve Prizes, each consisting of a complete Instruction Manual: Raymond Lefevre, Grassington; E. Inglis, Birmingham; Robert Lindsey, London, N.W.5; Gerard Read, Dublin; Dick Florance, Penzance; Roy Flanagan, Shipley; H. Stoyle and H. Larkin, Lichfield; C. D. Mackenzie, Balmoral; M. M. Plummer, Guernsey, C.I.; H. F. Dean, Didsbury, Manchester; W. A. Bradshaw, Sheffield; W. C. Harrison, Sheffield.

Specially Commended (Certificate of Merit): John Lewis, Chester; G. R. Buckingham, Leicester; Edward Allen, Cricklewood, N.W.2; A. S. J. Lightfoot, Newton Abbot; K. R. Dixon, Romiley, Cheshire; F. C. Pippet, South Shields; John A. Willman, Dumfries; J. D. Keey, Birmingham; J. Trotter, Netley Abbey; R. H. Browning, Liverpool; Cyril Ashford, Old Colwich.



An interesting group of Models from the September Contest. (Top) A neatly constructed well windlass, built by Miss A. M. Tyler. (Centre, left) A realistic traction engine by Cyril Walker. (Right) A very compact theodolite by G. H. Rhodes. Its builder terms it a "pocket" instrument! (Bottom) A view of the model Marshall Threshing Machine "in action." Constructed by E. Campbell

Foremost in interest amongst the models submitted in Section A was the Threshing Machine entered by E. Campbell. The model is included in the illustration and its realistic appearance will be apparent. The effect of realism has certainly been enhanced by the inclusion of miniature sacks and straw but the model has not been designed for effect alone. Its mechanical details have been modelled very carefully so as to reproduce with remarkable accuracy the various functions of a full-size "Marshall" threshing mill and elevator.

The mill or thresher itself contains a number of "beaters" and "riddles," which first remove the wheat pods from the straw, the pods afterwards falling down chutes into sacks placed on the left-hand side of the model. The straw, on being separated from the wheat pods, is carried on a moving belt to the base of the elevator on the right-hand side of the model. The elevator, which consists of a moving belt driven by Sprocket Chain, carries the straw to a suitable position whence it may be discharged into carts and carried away.

I have known for some time past that there are numerous girl readers of the "*M.M.*" and I have been distinctly disappointed by the fact that they do not enter the model-building contests more frequently. Presumably many Meccano girls are deterred from entering by the myth that they do not stand as good a chance as the Meccano boy. I was therefore particularly pleased to be able to award the Second Prize to Miss Alice M. Tyler, for her excellent model of a well windlass illustrated on this page. A glance at the photograph will show how closely the model resembles a type of hand-operated public well that is to be found in some very small English villages. The novel use of the Wood Roller as a barrel on which the bucket chain (a length of a Sprocket Chain) is wound will be noted and also the neatness of the bucket itself. The construction of the model throughout is excellent. No matter what prototype is chosen, good solid construction and the absence of bent or mutilated parts will always tell in a model's favour.

I feel sure that if all the other Meccano girls will only overcome their shyness and enter the model-building contests we shall see many more exceptionally fine models, which, like the well windlass, will not only be built on sound principles, but will display that artistic touch which few boys can obtain.

G. N. Rhodes and K. W. Cameron submitted models of equal merit, and therefore tied for Third Prize. Rhodes submitted two models as his entry, one being the pocket theodolite illustrated on this page, and the other a novel race game. The construction of the theodolite is shown clearly and it will be noticed how compact the instrument is. With its aid it is possible to measure heights, distances, areas, etc., although, of course, an absolutely level base must first be obtained. A very useful adjunct to this model would be a Meccano folding tripod such as that described under Suggestion No. 113 in the March, 1928, "*M.M.*"

Of a totally different nature was K. W. Cameron's entry. His model represents the British "Ljungstrom" locomotive, a detailed description of which appeared in the July, 1927, "*M.M.*" It has been constructed very cleverly and gives a remarkable impression of the size and power of this remarkable turbine-driven engine.

The model traction engine included in the accompanying illustration is only 10″ long, yet it is complete with steering gear, cylinders, dynamo, steam pressure gauge, and many other refinements. It was built by Cyril Walker, the winner of the First Prize in Section B, and in view of its size I think it is one of the best models of its kind that I have seen. Two other models of particular merit in Section B were a schooner by R. J. Whitney (Second Prize) and a fire-engine by M. H. Maufe (Third Prize).

New Meccano Models

Crazy Driver—Newton's Disc—Airship—Mobile Crane—Flip Flap, etc.

THE Meccano boy who favours models that are capable of performing remarkable feats should not fail to build up the motor car illustrated in Fig. 1. Even a casual glance at this remarkable machine with its no less remarkable occupants should arouse some amusement, but it is when the model is set in motion that the fun really commences!

Instead of travelling in a straight line, the machine makes a series of turns and "figure eights," frequently doubling back on its tracks until it finally comes to rest in a position little further from where it started! That is, of course, provided that in its wild career it does not meet with such obstacles as table legs or the operator's feet, but it would appear that the likelihood of the model making a complete run without any such mishap is very remote indeed!

Construction of the Crazy Driver

A Clockwork Motor fulfils the double duty of chassis and driving unit in this model and construction should therefore be commenced by attaching to it the four 1" × 1" Angle Brackets that form journals for the Rod carrying the rear road wheels and for the Axle Rod 8. The Rod 8 should be slipped in place and a ¾" Pinion and a ⅞" Bevel 7 se-secured upon it, while a second Bevel 6 should be secured to the Motor shaft. The ¾" Pinion meshes with a 50-teeth Gear Wheel 9 secured to the road axle, on which are also fastened two 2" Pulleys, Washers being placed between the bosses of the Pulleys and the Angle Brackets forming the bearings.

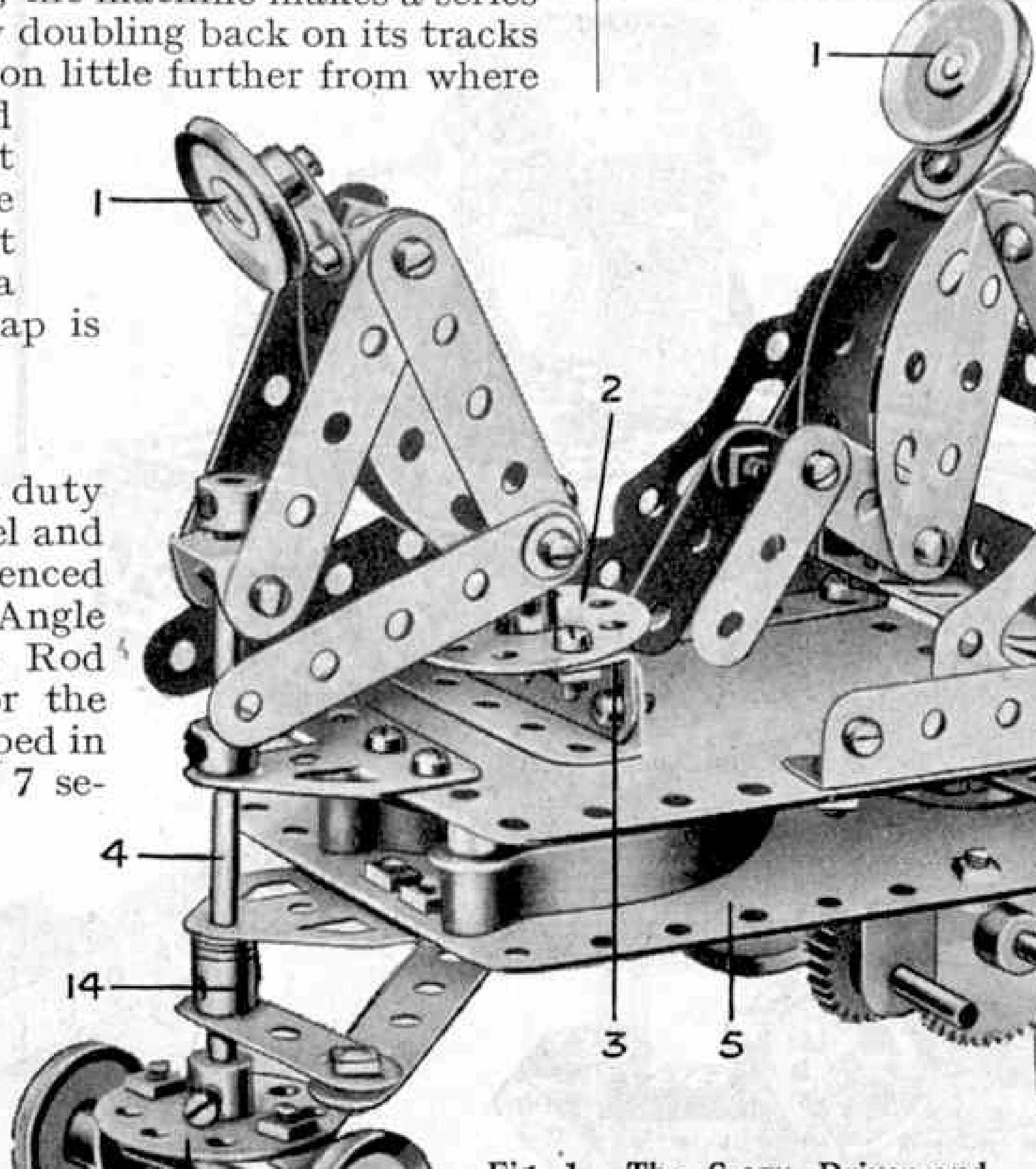


Fig. 1. The Crazy Driver and his weird vehicle (not to mention the passenger!)

The journals for the 2" Rod carrying the front wheels consist of Angle Brackets bolted to a Bush Wheel 10. The Wheel is secured to a 3½" Rod 4 journalled in a pair of Trunnions bolted to each Motor Plate 5, but before slipping the Rod in place, the crank mechanism that reciprocates the front wheels must be built up. This, as will be seen in the underneath view of the machine, comprises two 1½" Strips held apart from each other by means of Washers placed on the securing bolts.

The slot thus formed enables the square shaft of the Motor winding spindle to pass in between the Strips. As the spring of the Motor is allowed to run down, the winding spindle rotates very slowly and thus provides a very convenient method of imparting an oscillating movement to the front axle. When winding the Motor the 1½" Strips can be lifted off the spindle so that the winding key can be used.

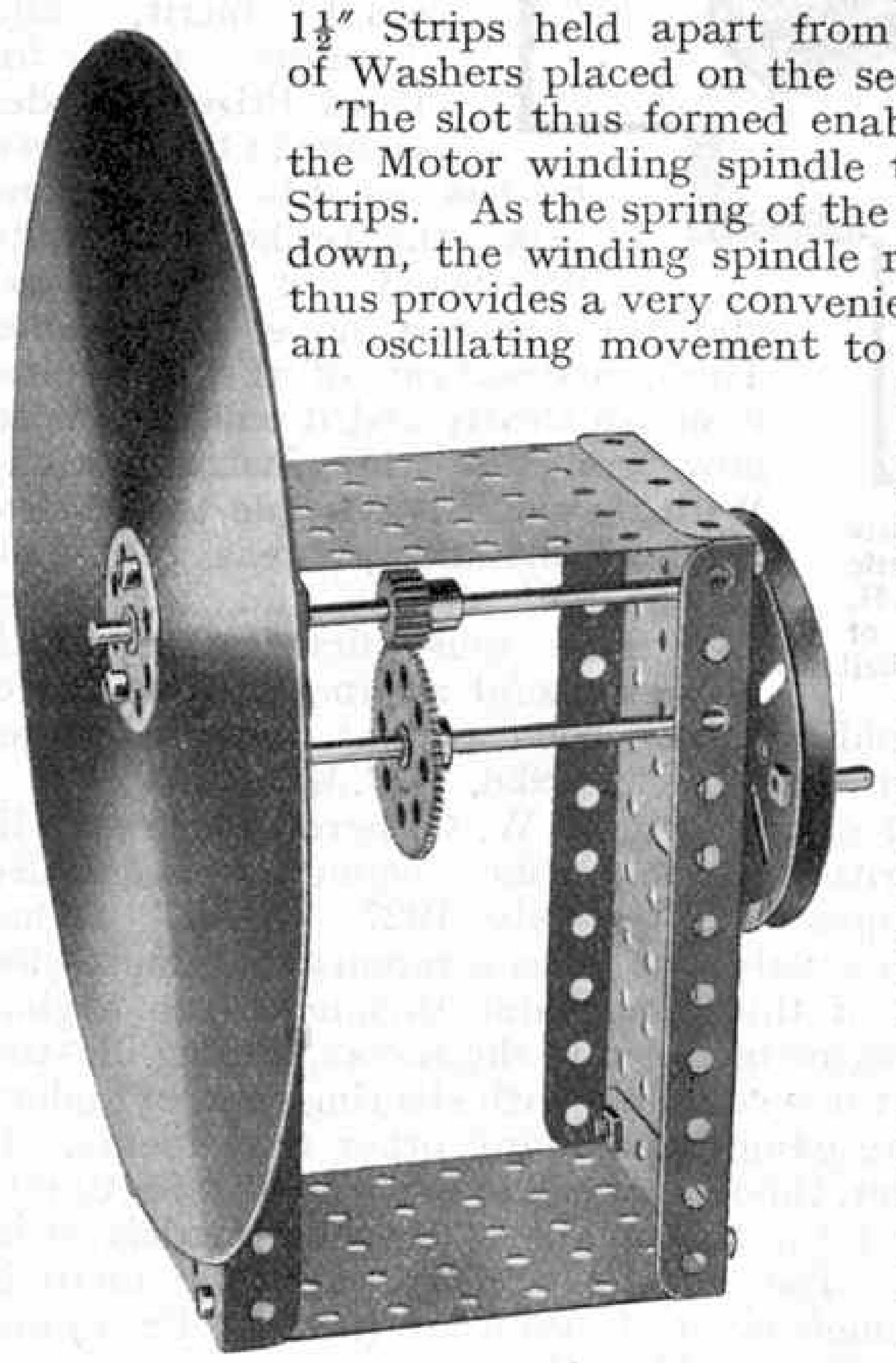


Fig 3. Newton's Disc

A Collar 13 is secured to one end of the arm 11 and to this Collar a 3" Strip 12 is pivoted by means of a bolt. The other end of the arm 11 is connected pivotally to a Crank 14 (see upper illustration) attached to the Axle Rod 4.

The heads of the driver and passenger consist of 1" Pulleys that are secured to the Flat Brackets forming their necks by ⅜" Bolts whose shanks are gripped in the bosses of the Pulleys. As a "safety first" measure the driver is secured to the car by means of a ⅜" Bolt that is gripped in the boss of the Bush Wheel 2, the Bush Wheel, in turn, being secured to a 2½" Angle Girder 3. For similar reasons the passenger is also firmly held down by a bolt and nut to a 2½" Angle Girder forming the rear seat of the vehicle.

As they are composed of 1" fast Pulleys 1, the faces of the driver and passenger wear a very "blank" look, but by substituting loose Pulleys, the additional holes will have the effect of changing their expressions to appropriate ones of startled surprise and exclamation!

The following parts are required to construct this model: 1 of No. 4; 8 of No. 5; 7 of No. 6a; 1 of No. 9b; 3 of No. 10; 4 of No. 11; 1 of No. 12; 4 of No. 12a; 1 of No. 15a; 2 of No. 16; 1 of No. 16a; 1 of No. 18b; 2 of No. 20a; 4 of No. 22; 4 of No. 9d; 3 of No. 24; 1 of No. 25; 1 of No. 27; 2 of No. 30; 44 of No. 37; 4 of No. 37a; 13 of No. 38; 1 of No. 48; 3 of No. 48b; 3 of No. 59; 1 of No. 62; 4 of No. 90a; 2 of No. 108; 6 of No. 111c; 2 of No. 126a.

This model may be built with a No. 7 Outfit or a No. 6 with the addition of 1 of No. 20a and 1 of No. 30.

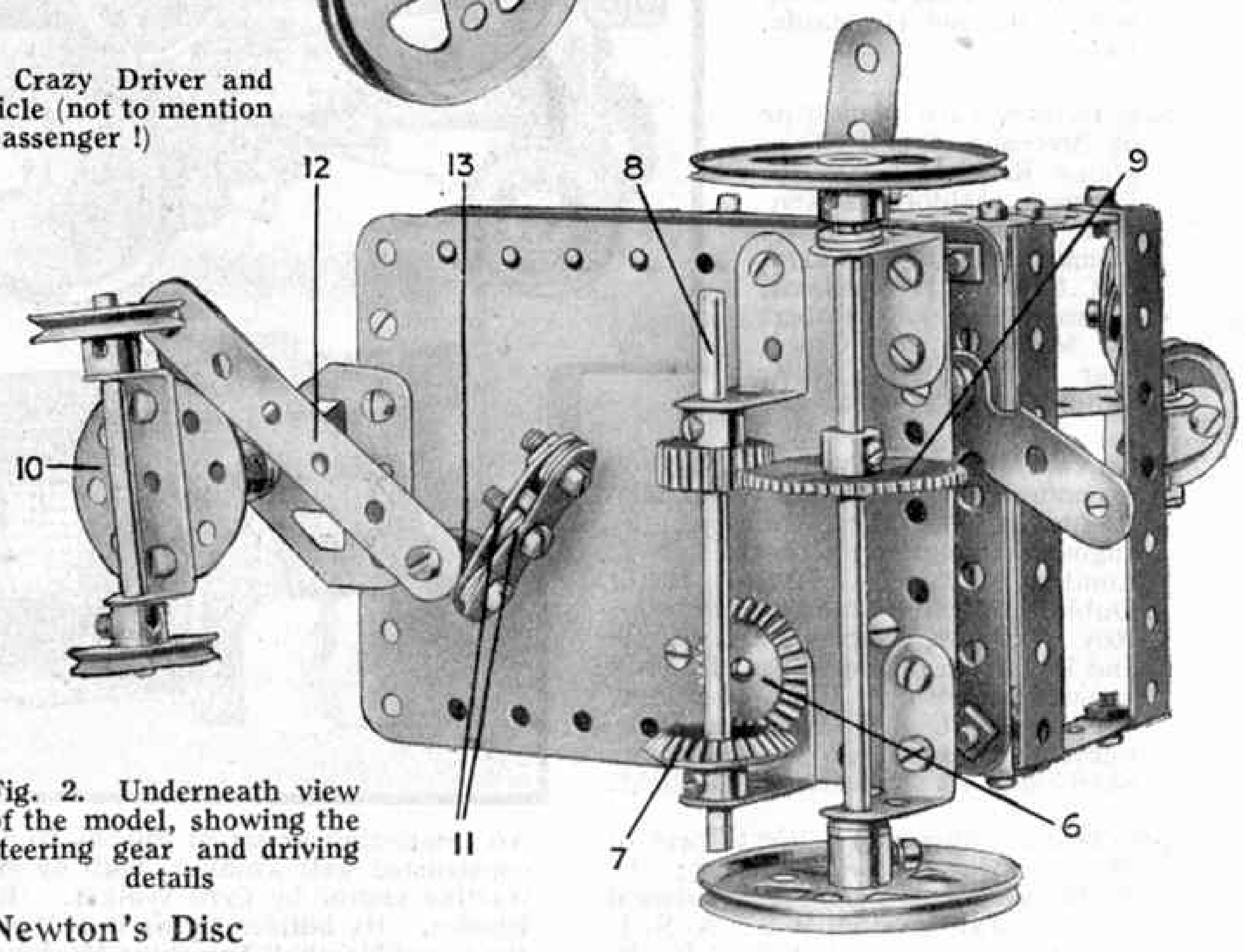


Fig. 2. Underneath view of the model, showing the steering gear and driving details

Newton's Disc

The model shown in Fig. 3 should appeal to Meccano boys who are interested in optics, for it demonstrates the composition of light remarkably well. White light is, of course, a combination of a number of colours, and by means of a prism these colours can be separated. And by reason of this fact, it will be obvious that white light can be produced by bringing together simultaneously each of the different colours of which it is composed. The disc shown in Fig. 3 enables this to be done.

A sheet of stiff white cardboard should be used for the disc and must be numbered off into seven sections, the sections being afterwards painted in colours in the following order; Violet, indigo, blue, green, yellow, orange, red. The disc is secured to a Bush Wheel upon a 3½" Axle Rod, which is rotated by means of the hand wheel through the ½" Pinion and 57-teeth Gear Wheel. When rotated at sufficient speed the disc will appear to be white.

In order to construct this simple demonstration of Newton's famous discovery, the following parts are necessary : 2 of No. 15a ; 1 of No. 19b ; 1 of No. 24 ; 1 of No. 26 ; 1 of No. 27a ; 6 of No. 37 ; 2 of No. 52 ; 2 of No. 53 ; 2 of No. 59 ; 1 of No. 115 ; Piece of stiff white cardboard for the colour disc.

A Realistic Miniature Airship

Every model builder, whether young or old, will have been interested in the voyage of the German airship, *"Graf Zeppelin,"* across the Atlantic, and no doubt will be anxious to build up a replica of it. The model of this goliath of the air shown in Fig. 4 is certainly small, but this does not prevent it from looking remarkably realistic and it has the advantage that it can be built with a very small Outfit.

Four 12½″ Strips slightly curved form the "envelope" and are bolted at each end to Double Brackets. The "cabin" consists of two 2½″ × ½″ Double Angle Strips secured to one of the 12½″ Strips by means of two Angle Brackets. Two Angle Brackets are also bolted to the rear end of the uppermost 12½″ Strip, and a Flat Bracket is secured to one of these by a bolt. A 2½″ Strip secured between the Flat Bracket and the Angle Bracket completes the rudder. The "elevators," of which there are two, are constructed in a similar manner to the rudder and are bolted to the side 12½″ Strips. Those model-builders who have the extra parts can arrange matters so that the airship will travel across the room in a most realistic manner. In order to do this it will be necessary to fit the model with a loose Pulley and a hoisting arrangement similar to that included in the Telpher Span, model number 1.20 (see 00-3 Manual, page 30).

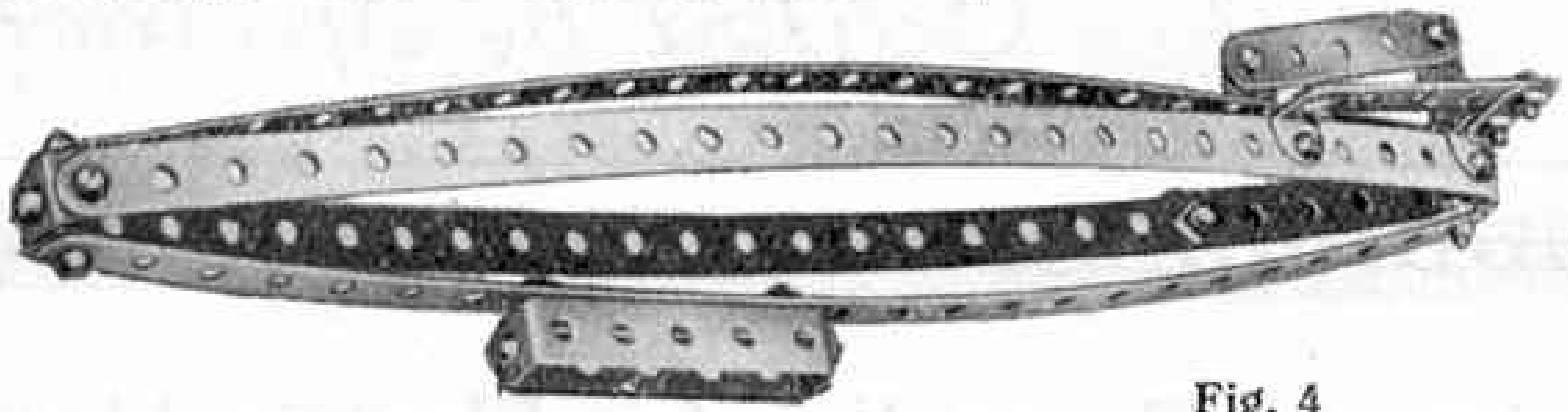


Fig. 4

Fig. 4 (Above) : A Realistic Airship

Fig. 5 (Left) : The Meccano Flip-Flap

Fig. 6 (Right) : Mobile Crane

Fig. 7 (Bottom) : A Neat Square-rigged Schooner

The simple nature of the model is evidenced by the few parts that are needed in its construction. They are ; 2 of No. 1 ; 3 of No. 5 ; 3 of No. 10 ; 4 of No. 11 ; 8 of No. 12 ; 26 of No. 37 ; 2 of No. 48a.

The Meccano Flip-Flap

No doubt many Meccano boys during their holidays have visited fair grounds where they have obtained much fun by being whirled round and round in a big wheel or fly-boats, or precipitated down a switch-back in the frailest of cars ! Besides these "fun-providing" machines there is another kind known as the flip-flap, which is capable of providing perhaps some of the greatest thrills. Often advertised as "A Journey to the Moon" or by some other alluring title, the machine consists of two or more arms pivoted at one end and carrying at the other cars in which passengers may sit. The arms are driven by steam or electric power and the gearing is so arranged that they travel in opposite directions, while some device is incorporated so that the direction of the arms is reversed when they approach the ground on either side.

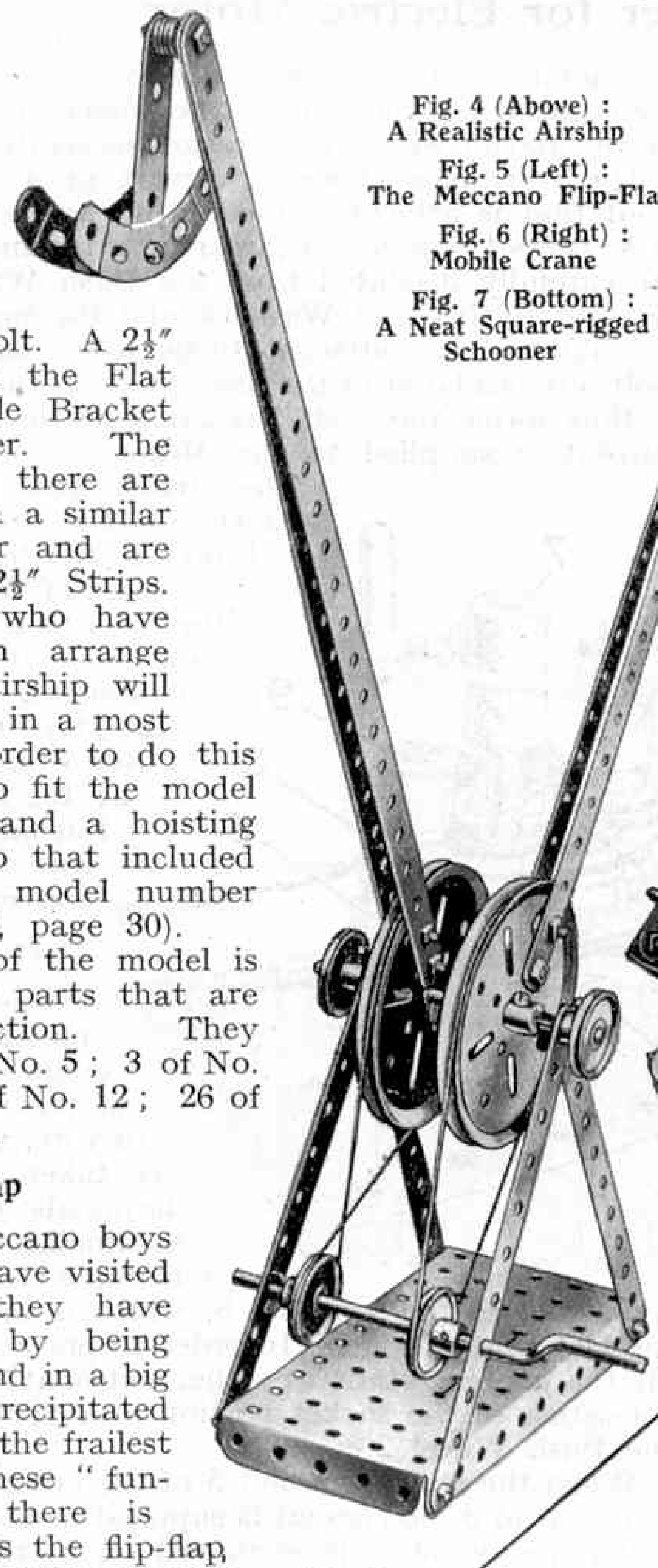


Fig. 5

The Meccano model shown in Fig. 5 functions quite realistically. The base consists of a 5½″ × 2½″ Flanged Plate to which are bolted four 5½″ Strips. These Strips form bearings for a 3½″ Axle Rod carrying two 3″ and two 1″ Pulleys. To each 3″ Pulley two 12½″ Strips are bolted to form the arms to the outer ends of which the boats are pivoted. Each boat consists of two 2½″ Curved Strips spaced apart by Double Brackets and attached to a 2½″ Strip. The upper ends of the 2½″ Strips are pivoted to the ends of the 12½″ Strips by ⅜″ Bolts, Washers being placed on the latter between the Strips, so that the inner sides of the boats will not 'foul' the arms.

The model is operated by means of the Crank Handle carrying two 1″ Pulleys, which are connected by means of cord to the 3″ Pulleys. One of the cords must be crossed so that the arms move in opposite directions on rotation of the Crank Handle.

The following are the parts required for this model ; 4 of No. 1 ; 2 of No. 2 ; 2 of No. 5 ; 2 of No. 11 ; 1 of No. 16 ; 1 of No. 19s ; 2 of No. 19b ; 4 of No. 22 ; 6 of No. 35 ; 8 of No. 37 ; 6 of No. 37a ; 8 of No. 38 ; 1 of No. 52 ; 4 of No. 90a ; 6 of No. 111c.

Mobile Crane

The prototype of the model shown in Fig. 6 is to be found in many engineering works and transport depots. It is particularly adapted for work in goods yards where space is limited, as its short wheel-base enables it to be controlled with the greatest ease. The crane can be manœuvred so that when the jib is lowered it can be passed through the open door of a covered railway wagon or motor van, and so deal with any heavy material that may be inside. Swivelling is effected by means of the rear pair of road wheels which also form the driving wheels.

To construct the Meccano model, bolt two 5½″ Strips to each side flange of a 5½″ × 2½″ Flanged Plate, so that their ends form pivots for the jib which consists of two 12½″ Strips spaced apart by means of a 2½″ × ½″ and a 1½″ × ½″ Double Angle Strip. The jib is pivoted by means of lock-nutted bolts and is raised or lowered by operating the 1″ fast Pulley on a 3½″ Axle Rod (if possible a Bush Wheel fitted with a ⅜″ Bolt should be used here as a hand wheel). A length of cord is secured to the 3½″ Axle Rod and the other end is tied to the 2½″ × ½″ Double Angle Strip on the jib.

The hoisting cord is wound round the shaft of the Crank Handle and passes under a 3½″ Axle Rod at the lower end of the jib. It is then led over a ½″ loose Pulley on a 2″ Rod at the jib head, and finally secured to the load hook.

Two 3″ Pulleys, which form the front road wheels, are secured to a 3½″ Axle Rod journalled in the side flanges of the Flanged Plate, and the rear road wheels—1″ fast Pulleys—are secured to a 1½″ Rod journalled in a Cranked Bent Strip. A Flat Bracket is firmly secured to the top of the latter by means of a ⅜″ bolt and nut, and the shank of the bolt is afterwards passed through the Flanged Plate and fitted with lock-nuts. A ½″ Reversed Angle Bracket next is bolted to the Flat Bracket and connected by Strips to a Bush Wheel on a 2″ Rod forming the steering column. By rotating the 1″ Pulley on this Rod, the rear wheels are deflected to either side.

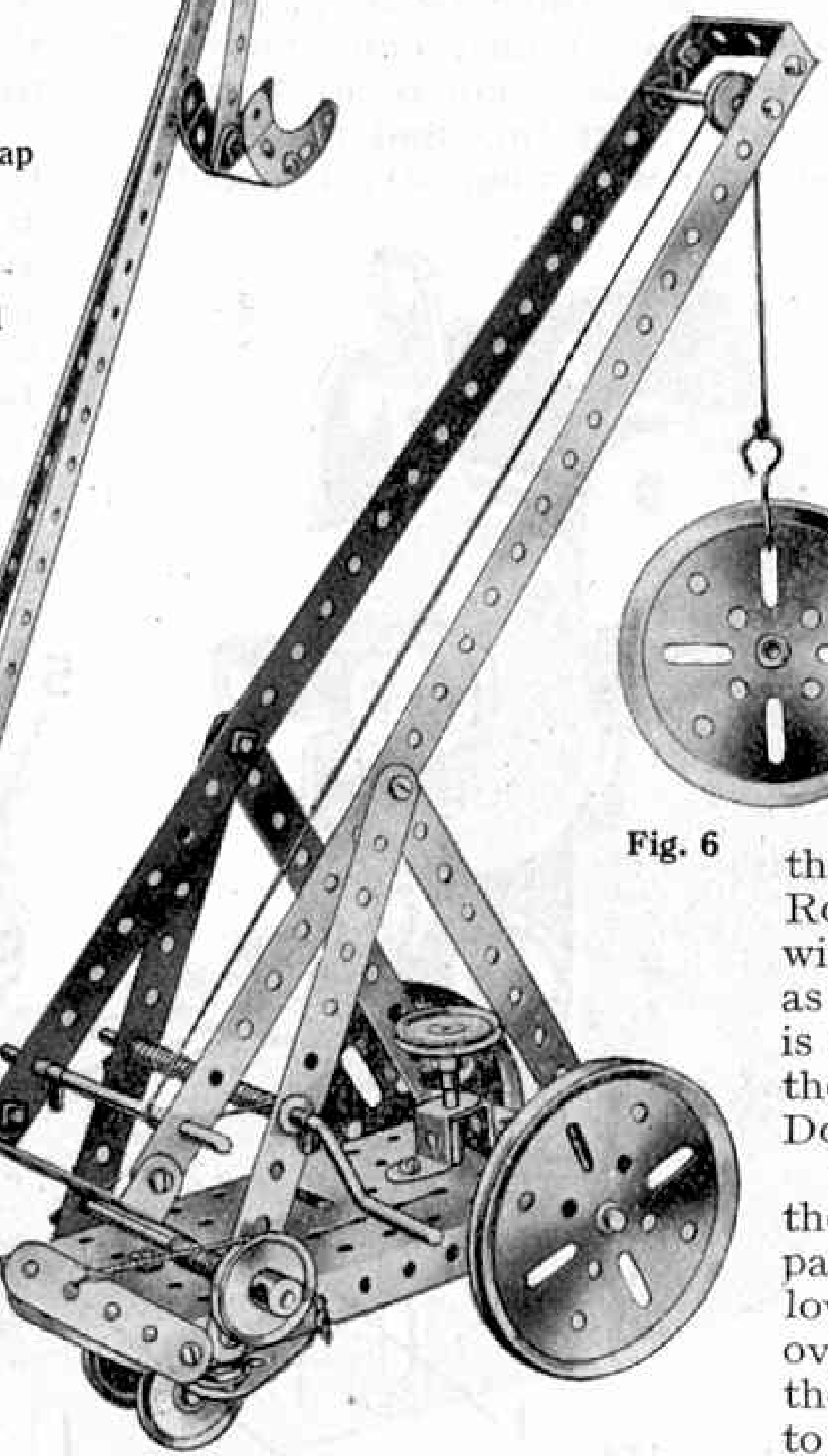


Fig. 6

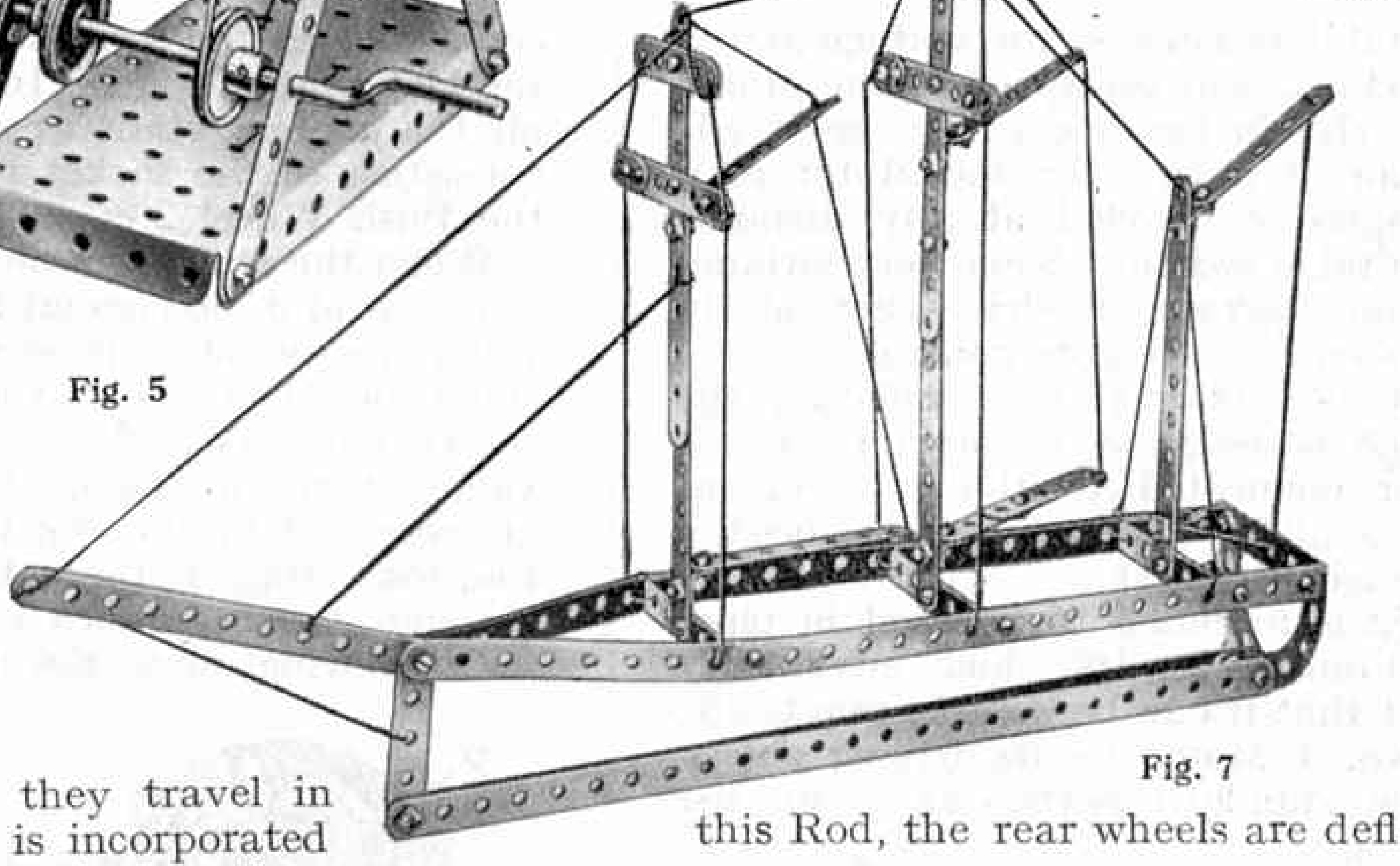
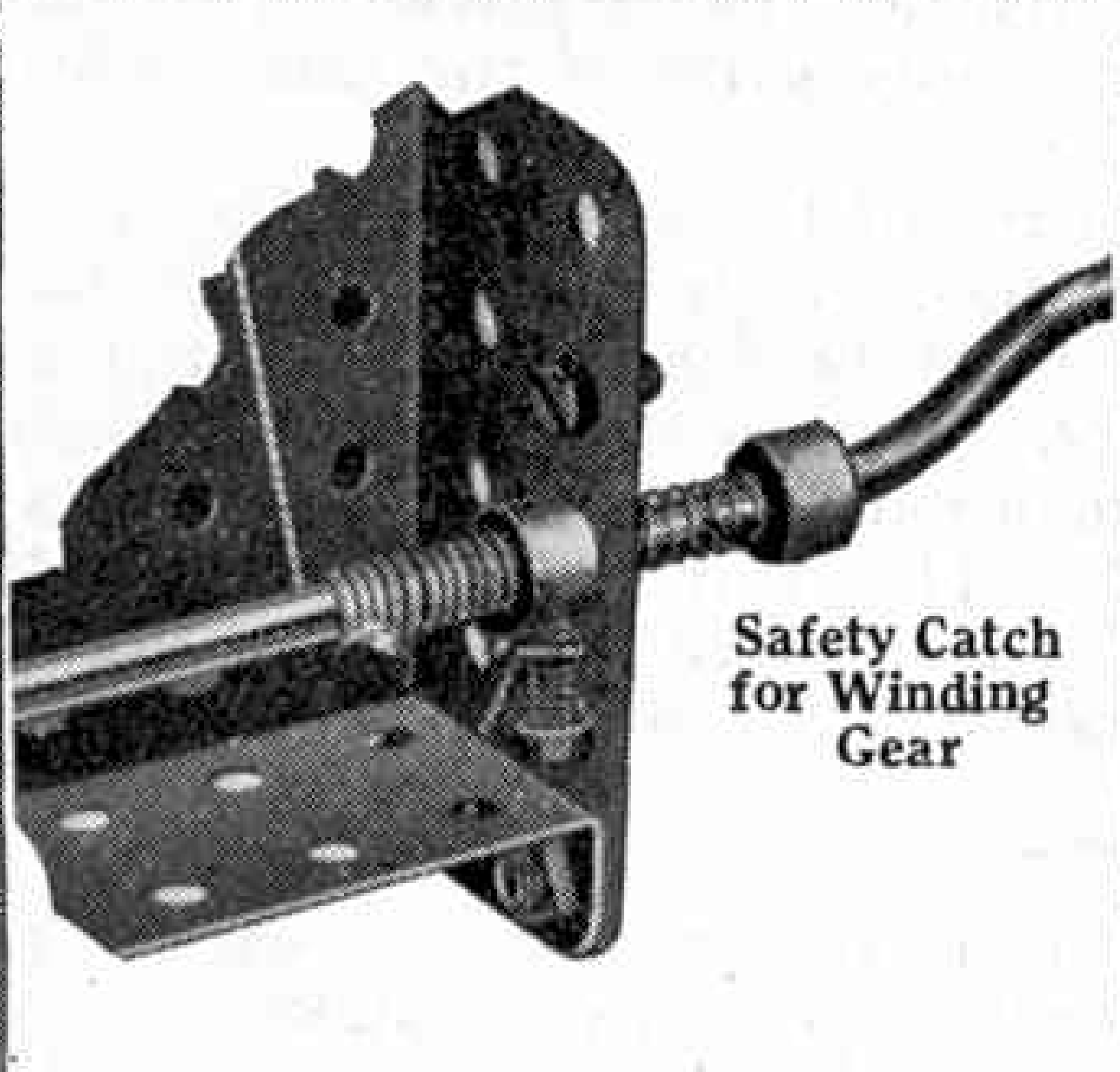


Fig. 7

Square-rigged Schooner

The model shown in Fig. 7 represents a square-rigged schooner and reproduces the lines of this type of vessel quite well. The hull is built from four 12½″ Strips bolted at the fore end to a 2½″ Strip and at the after end, to two 2½″ Curved Strips and a 2½″ × ½″ Double Angle Strip. The masts consist of Strips secured to further 2½″ × ½″ Double Angle Strips which are placed between the 12½″ Strips of the hull. The appearance of the model is considerably improved by adding "rigging" consisting of lengths of cord, as shown in the illustration.



Safety Catch for Winding Gear

Suggestions Section

Edited by "Spanner"

(152)—Resistance Controller for Electric Motor

THERE are two methods of driving Meccano models, i.e., by hand power or by mechanical means. Whilst hand power may be most suitable for simple models, there is no doubt that a mechanical drive is much more interesting and realistic. There is a real thrill to be obtained from watching, say, a model block-setting crane or dragline going through its various motions at the touch of a lever, exactly like its prototype. Such a result could only be attained effectively by means of a mechanical prime-mover.

The Meccano Clockwork Motor and the No. 1 and No. 2 Electric Motors have been specially designed for driving Meccano models. The Clockwork Motor is a very reliable source of power for models of all types. It is entirely self-contained, is provided with a reversing mechanism, and it costs nothing to run. Many examples of its adaptation to models occur in the Manual of Instructions.

From the point of view of realism and simplicity of operation, however, the Meccano Electric Motors are unexcelled. They form an ideal means of driving models of all kinds continuously. A start, stop, and reverse switch normally is employed to control both types of Motor, but by the addition of an adjustable resistance, the voltage across the Motor terminals may be modified and the speed of the Motor adjusted to within fine limits. Herein lies one of the great advantages in employing this form of power, for the Motor may be stopped, started, and its speed controlled at any distance from the model by means of a suitable switch. Some very striking effects may be obtained from certain models—particularly miniature railways—by this system of "remote control."

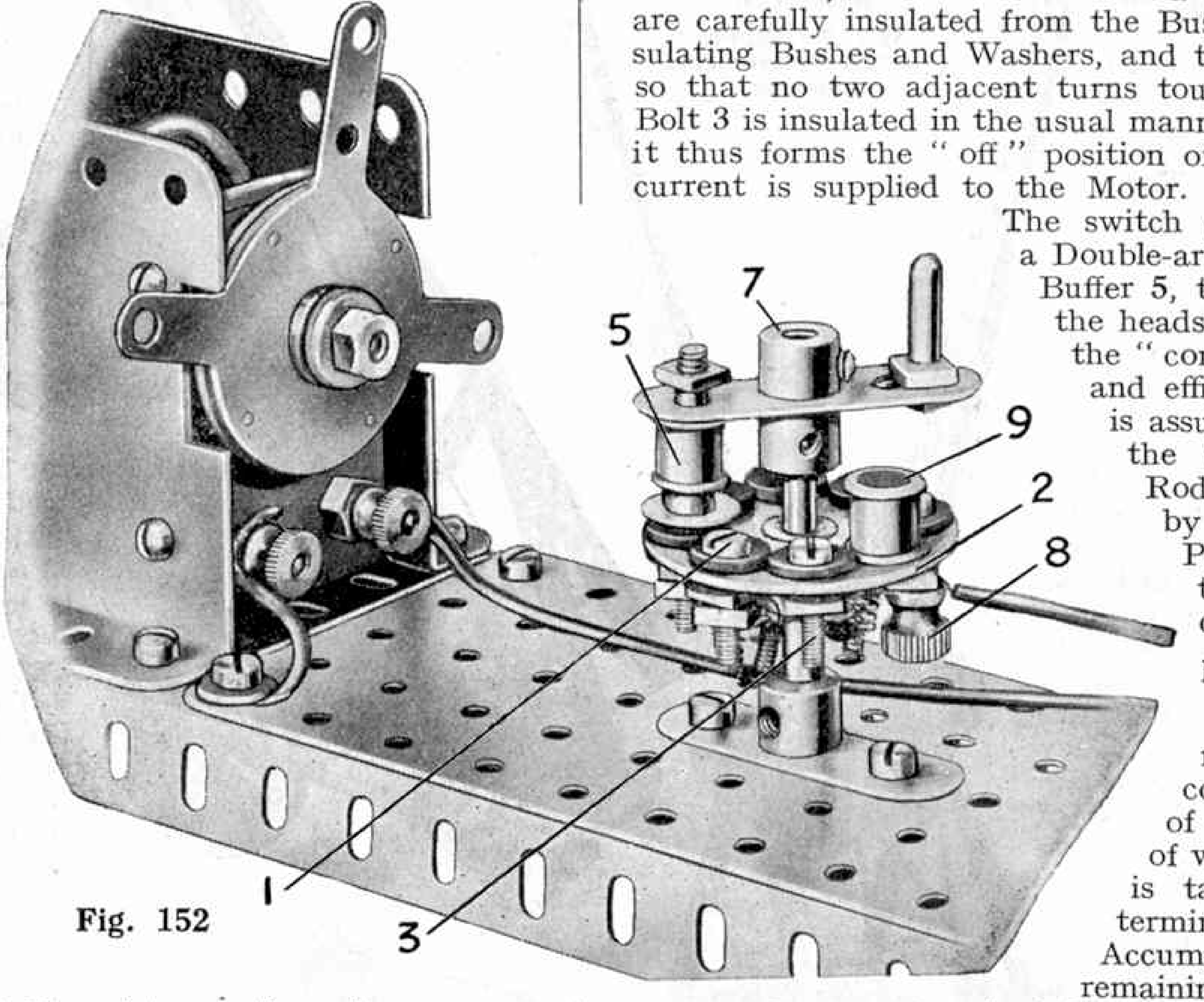


Fig. 152

A Resistance Controller may be obtained for regulating the speed of the No. 1 Motor, which is designed to run off a 4-volt Accumulator or a Transformer connected to the A.C. mains. The No. 2 Motor is wound for a higher voltage and its speed is controlled by means of a special Rheostat.

The device shown in Fig. 152 is intended to be used in place of the standard Resistance Controller. Its chief advantages are its compactness and the fact that it can be used in practically every model that employs a No. 1 Motor for its driving power. It is constructed entirely from standard parts. It is for use with the low voltage Motor only and must on no account be used with the high voltage type.

The Built-up Controller

Fig. 152 shows the complete controller mounted on a base and connected to a 4-volt Meccano Motor; Fig. 152b is an underneath view of the device with the resistance elements in place; and Fig. 152a is a detail view of the switch arm. A point to be noticed about the controller is the simple arrangement by which it may be fitted to any model without alteration in its design.

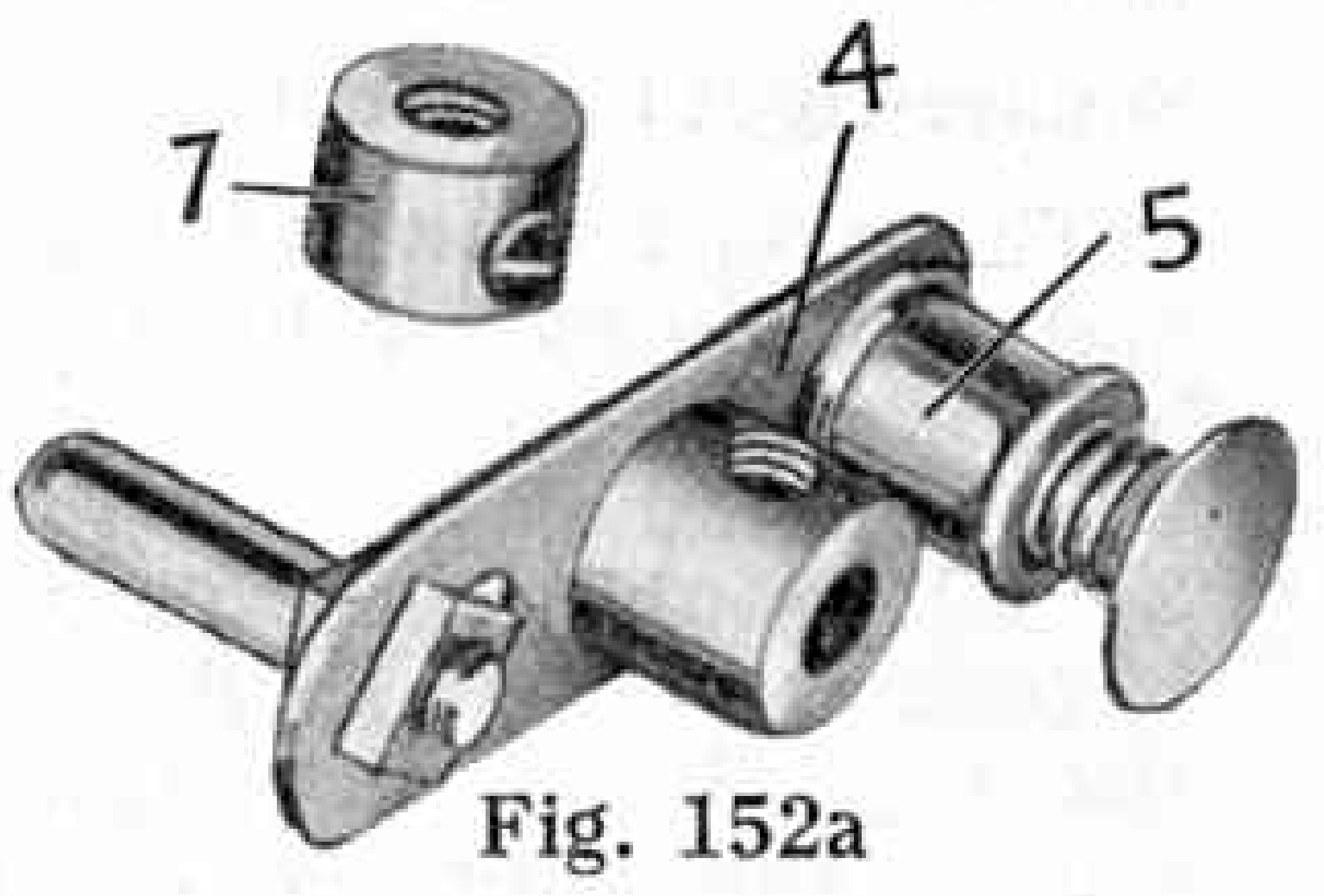


Fig. 152a

The resistance elements consist of a short length of Spring Cord that is attached at equal distances to the shanks of six 6 B.A. Bolts 1, one of which carries a terminal 8. The 6 B.A. Bolts are carefully insulated from the Bush Wheel 2 by means of Insulating Bushes and Washers, and the Spring Cord is drawn out so that no two adjacent turns touch each other. The 6 B.A. Bolt 3 is insulated in the usual manner but remains unconnected; it thus forms the "off" position of the controller, in which no current is supplied to the Motor.

The switch arm (Fig. 152a) consists of a Double-arm Crank 4 carrying a Spring Buffer 5, the head of which presses on the heads of the 6 B.A. Bolts forming the "contact studs." Thus smooth and efficient contact with the studs is assured. The Crank pivots on the top end of the supporting Rod 6 and is retained in position by the Collar 7. A Threaded Pin on the other extremity of the switch arm forms a convenient handle.

Electric Connections

One of the Motor terminals is "earthed" by connecting it to the metal base of the model by a short length of wire, whilst the other terminal is taken direct to one of the terminals of the Meccano 4-volt Accumulator (or Transformer). The remaining terminal of the latter is connected to the terminal 8, which is mounted on the shank of the last contact stud. In order to prevent the switch arm riding off the contact studs at either extremity of its travel, a stop 9, consisting of the socket portion of a Spring Buffer, is secured to the Bush Wheel 2.

When the spring contact 5 of the switch arm is pressing on the "off" stud 3, no current is supplied to the Motor, of course. But when the switch arm is moved on to the next stud, the Motor commences to revolve at a slow rate of speed, due to the fact that the current has to flow through the entire resistance and that its value is therefore small. (Actually it is the voltage that is "dropped" or expended in the resistance. This causes the current to drop too, for voltage is the "driving force" or pressure forcing current through the resistance of a circuit).

On moving on to the next stud, one stage of the resistance is cut out and the speed of the Motor increases. Step by step, as more resistance is taken out, the speed of the Motor mounts up until the switch arm is on the last stud carrying the terminal 8, when all the resistance is cut out and a straight-through path is afforded for the current from the Accumulator to the Motor. The Motor now runs at its greatest speed and develops its maximum power.

Another use for the controller is the dimming of lamps.

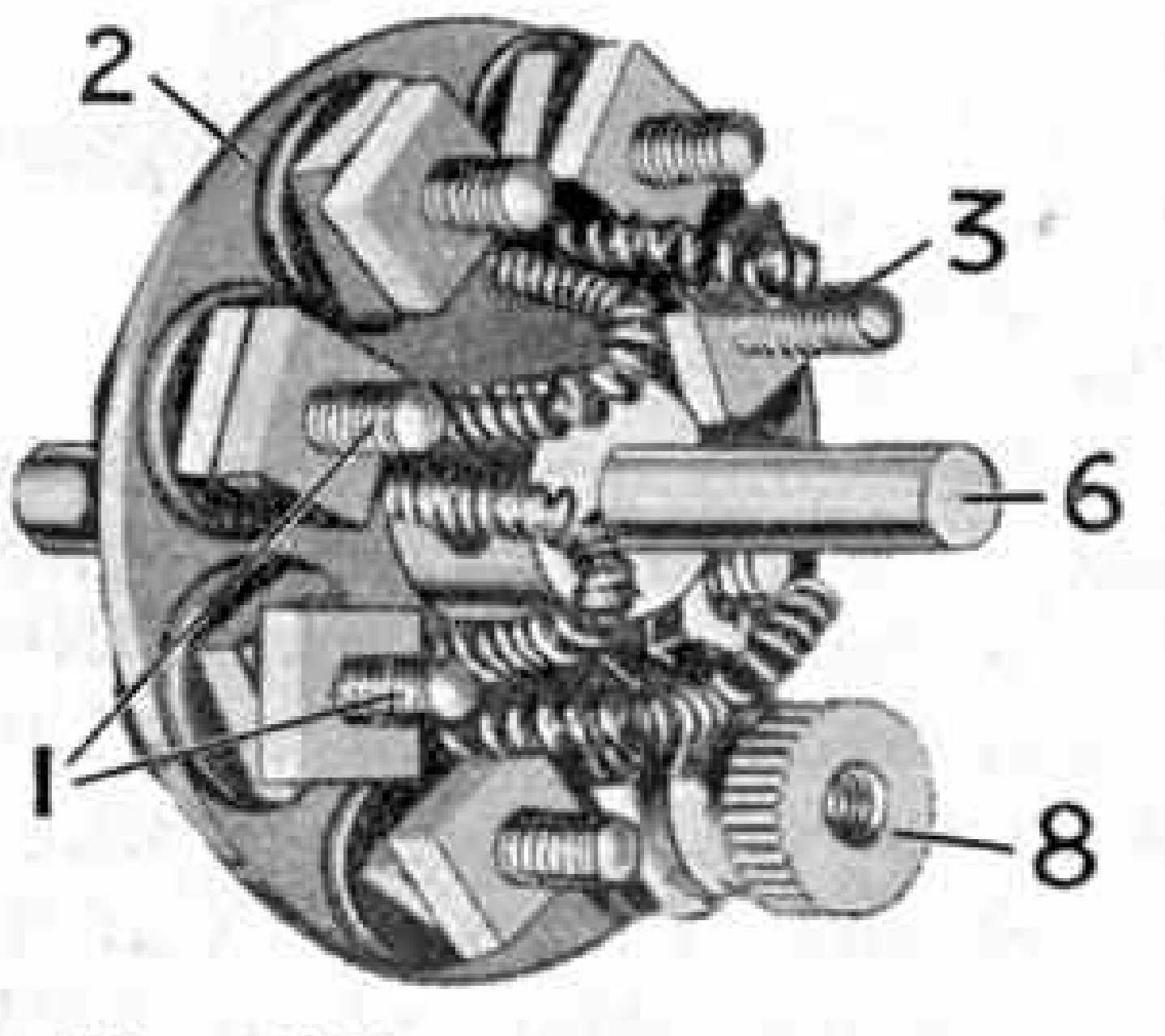


Fig. 152b

(153)—A Meccano Gyroscope

(*Thomas T. Smith, B.A., Hallbankgate, Carlisle*)

Everyone is familiar with the small gyroscope tops sold in most toyshops. They consist essentially of a heavy wheel, the rim of which is much thicker in proportion to the rest. When the wheel is set in rapid motion, the gyroscope is capable of balancing itself on a taut string stretched between two supports, on the edge of a tumbler, and in similar seemingly impossible positions.

The gyroscope is certainly not a toy, however, for it has many applications in practice. One of its uses, for example, is found in the gyro compass. This ingenious device was described fully in an article that appeared in the January and February, 1928, *"M.M.,"* and with the aid of the Meccano Gyroscope shown in Fig. 153 many of the points mentioned in that article may be clearly demonstrated.

The gyroscope proper consists of two Hub Discs 1 mounted face to face and secured to an Axle Rod by means of two Bush Wheels. In order to increase the mass of the gyroscope near the periphery, four 50-gramme Weights 2 are secured to the inside of each Hub Disc in the positions shown.

The swinging frame consists of a Circular Strip 3 that is attached by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets and lock-nuts to a Strip bent in the form of a U. The U-shaped Strip has a Double-arm Crank bolted to its lower extremity to form a means of connection with a $1\frac{1}{2}''$ Rod. This Rod, which forms a pivot, is free to turn in a reinforced bearing consisting of a Double Bent Strip and a $1\frac{1}{2}''$ Strip bolted to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate forming the base of the model.

To start the gyroscope, a length of string is wound on to the spindle and its end is then given a smart pull so that the wheel is set spinning in a clockwise direction. If now the U-frame is turned also in a clockwise direction the edge of the Circular Strip remote from the observer dips. When a reverse movement is given to the U-frame, the same end of the Circular Strip rises. This is due to the tendency of the axis of rotation of the gyroscope always to point in the same direction in space. If the direction is changed the gyroscope resists the change by executing a movement in a plane at right-angles to that in which the change occurs.

If now we make the Circular Strip dip by adding a weight on one side, the gyroscope demonstrates its resistance by turning slowly about the vertical axis.

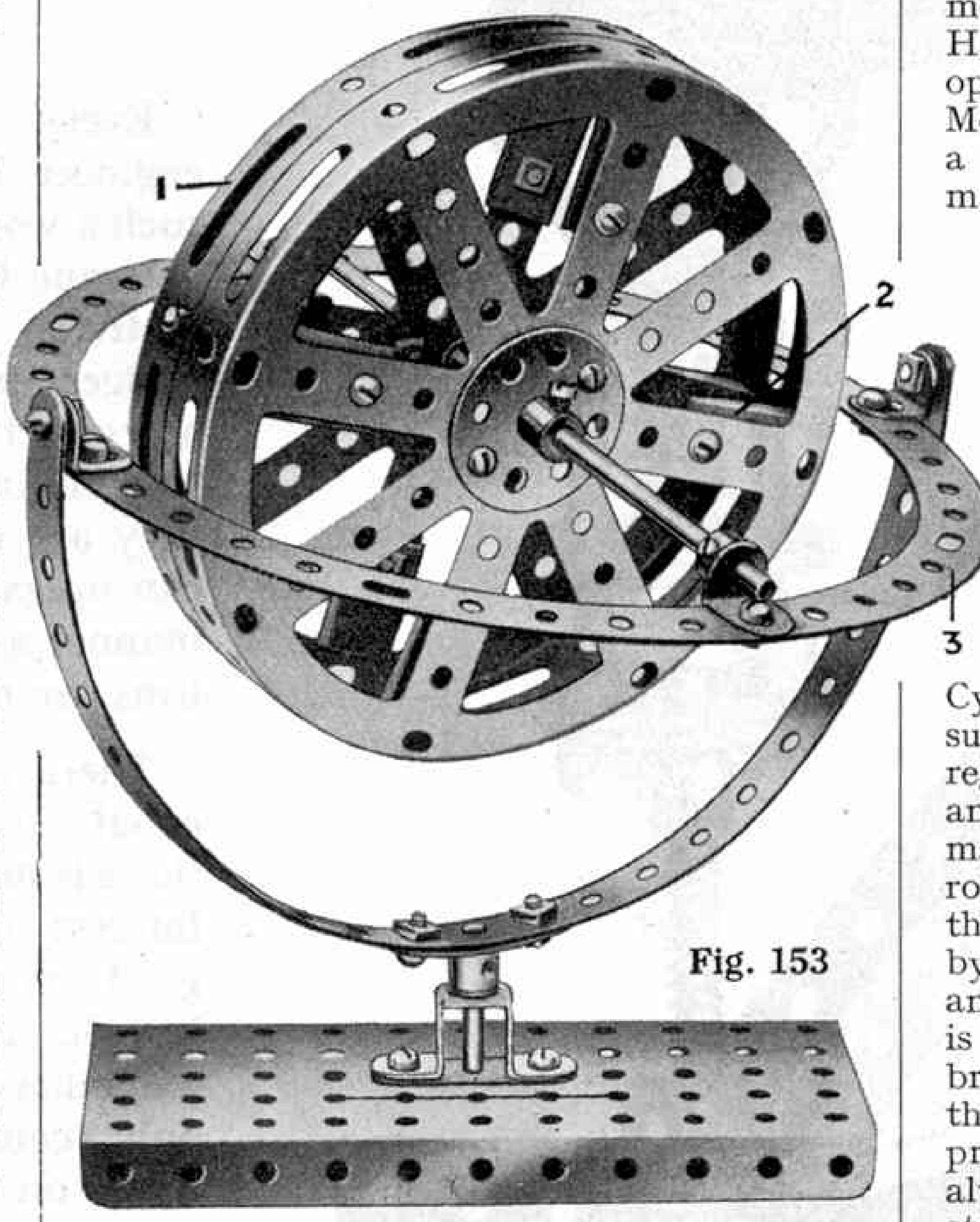


Fig. 153

Other investigations in gyroscopic motion may be readily carried out with this simple model, and many readers will undoubtedly find that a thorough knowledge of the principles involved may be gained quickly and easily by making a few first-hand experiments.

(154)—A Useful Measuring Instrument

(*A. E. Wood, Rotherham*)

Many Meccano models are designed with a view to practical use. Several such models have appeared recently in the *"M.M.,"* such as a planimeter, caliper-gauge, scales, pantograph, etc., and the model opisometer shown in Fig. 154 is yet another addition to the list.

It is a very simple device having similar functions to the map-measuring instrument described under Suggestion No. 138 (see October, 1928, *"M.M."*) i.e., the measuring of the perimeter of bodies, contours, and map routes, etc., although its design is quite different. It consists essentially of a Face Plate 1 mounted on a Screwed Rod 3 and attached by a bolt to a Coupling 2, the lower tapped hole of which engages with the thread of Rod 3. The Rod itself is secured in two Cranks that are bolted to a $2\frac{1}{2}'' \times 1''$ Double Angle Strip.

The Face Plate is run to one end of the Screwed Rod and the instrument rolled round the perimeter of the object, or along the line that is to be measured. As the Face Plate revolves it moves along the Threaded Rod and its movement may be measured by means of a scale 4. The latter consists merely of a piece of paper stuck to the Double Angle Strip. It may be graduated by running the instrument along a line of given length and marking the position of the Face Plate against the scale for each inch or so.

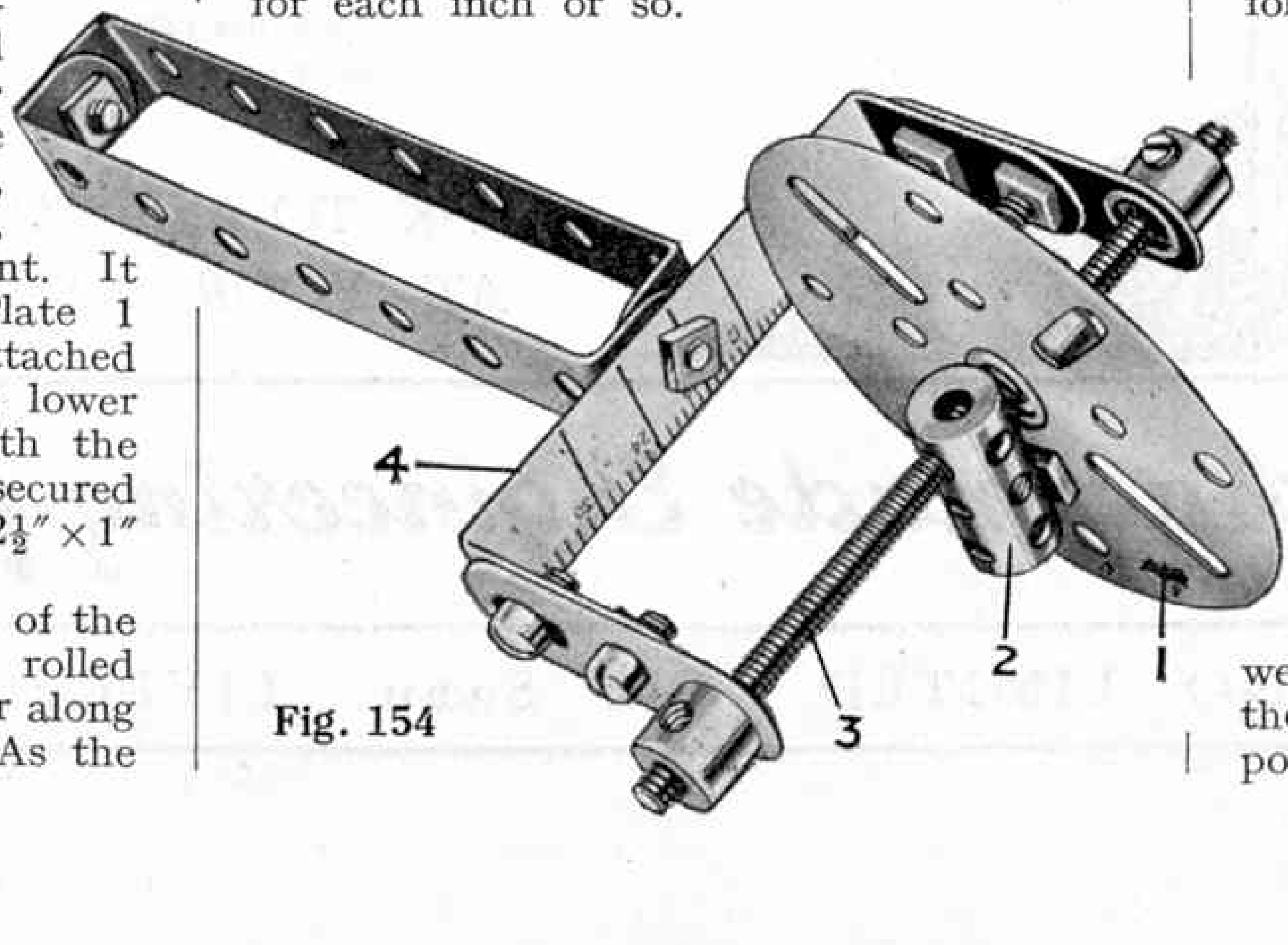


Fig. 154

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.45). Vernier Attachment for Condensers.—Many *"M.M."* readers who are radio enthusiasts must have often wished for a simple means whereby a slow motion may be imparted to condenser dials. H. Fox (Christchurch, New Zealand) operates the dials with the aid of a few Meccano parts. A 1″ Pulley is shod with a Rubber Ring (part No. 155), which makes frictional contact with the periphery of the dial, and the pulley is secured to a Rod journalled in a suitable position in the panel of the set. This is quite a good idea, but we think still better results would be obtained if the Rod were fitted with a small piece of rubber, firmly glued in place, instead of the Pulley and Rubber Ring. Much greater reduction, and therefore finer tuning, would be obtained by this means.

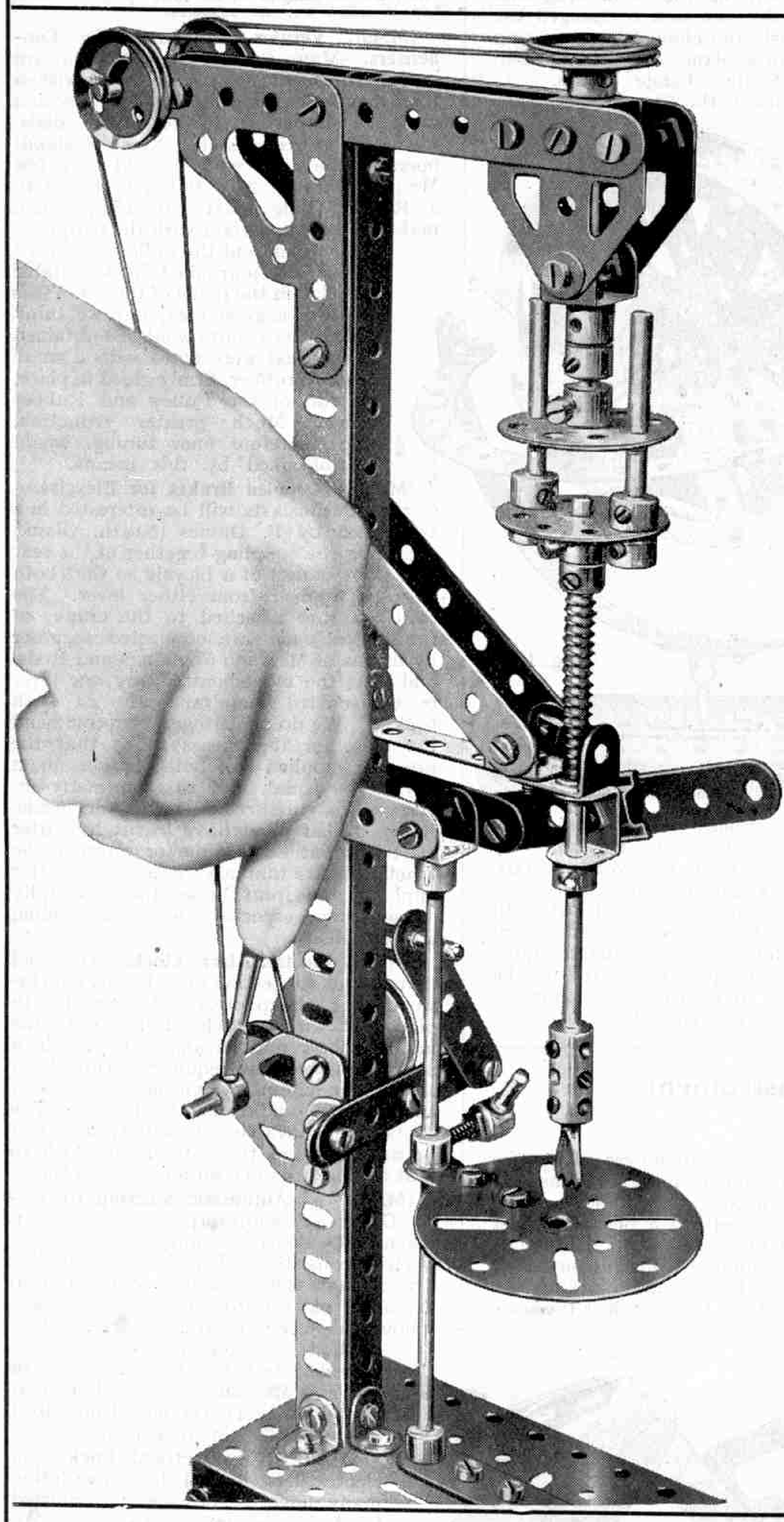
(M.46). Coupled Brakes for Bicycles.—Cycling enthusiasts will be interested in a suggestion by F. Davies (Neath, Glam.) regarding the coupling together of the rear and front brakes of a bicycle so that both may be applied from either lever. The rods that are attached to the cranks of the brake levers are connected together by means of Meccano Couplings and Rods, and thus the movement of any one lever is transmitted simultaneously to both brakes. We do not altogether recommend the idea, for it appears to us that the pressure applied to both brakes must always be equal, and this, in many instances, is neither advisable nor safe. Every cyclist must have learnt by bitter experience at some time or another the drastic results that may be expected after applying the front brake too powerfully or suddenly, especially when descending a steep hill!

(M.47). Electric Alarm Clock.—The chief item in this suggestion of J. Evans (Northwood) is a cheap clock. A short length of copper wire is soldered lightly to the minute hand and arranged to touch a contact at the time required. This closes an electric circuit which includes a bell and battery, and rings the bell. The contact is movable, of course, and can be moved round the dial of the clock so that the alarm can be set for different times.

(M.48). Automatic Steering Gear.—J. Gladwin (Scunthorpe) sends in an ingeniously contrived automatic steering device, consisting of a link mechanism driven from the propelling motor and so arranged that the front wheels of a vehicle follow a very erratic course. This method of steering is not new, however, but has been included in previous Meccano models. It is used in the Crazy Driver model described on page 324 of this issue.

(M.49). Electrical Lock.—An electrically-operated lock exhibiting many novel features was submitted by A. V. Tidcombe (Bristol). Apparently its chief advantage over ordinary locks is to be found in the automatic opening of doors. To obtain this result, however, it would be necessary to attach a spring or weight to the door, but this would prevent the latch being lifted easily unless a specially powerful electro magnet were used.

MECCANO

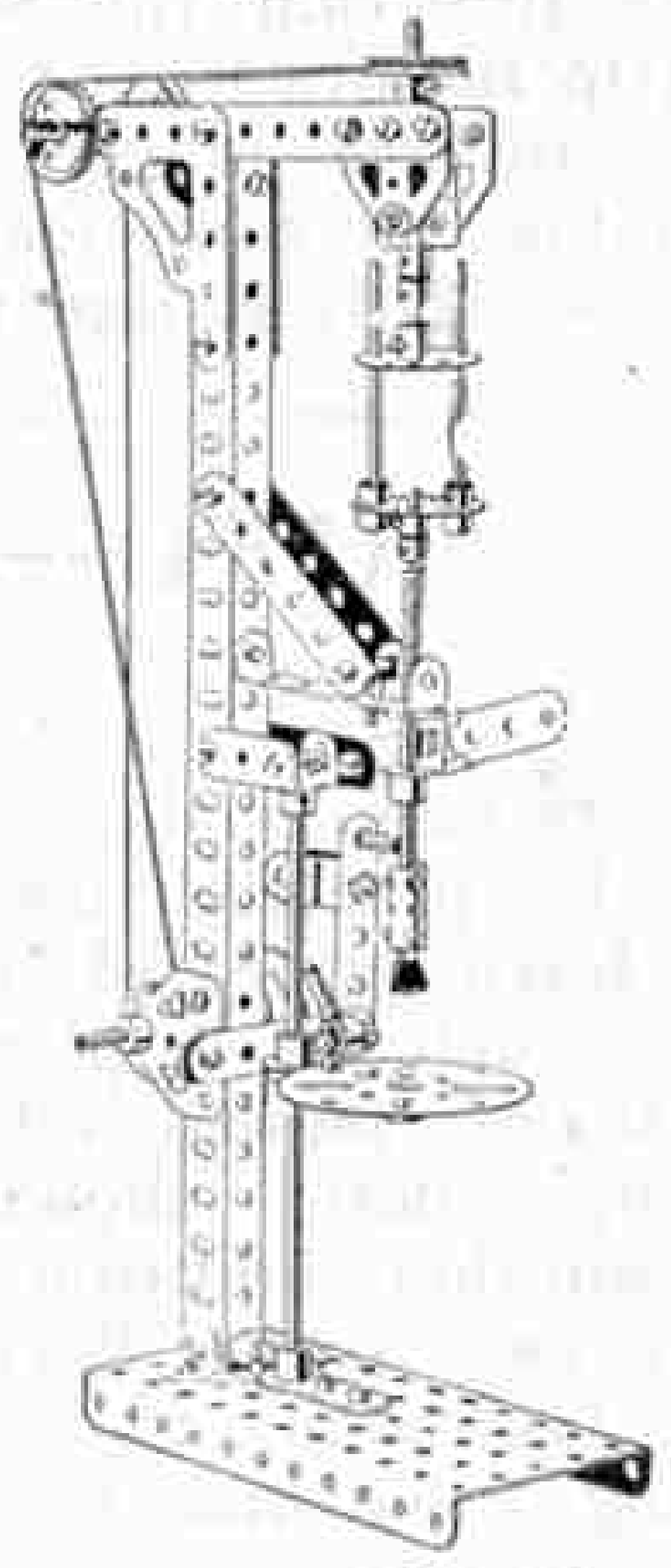


Real Engineering for Boys

Every boy may be a practical engineer before he grows up. With such a wonderful engineering system as Meccano he can design and build locomotives, aeroplanes, cars, cranes, bridges, and hundreds of other models, all correct in every detail. Not only can he build innumerable models, but, when they are completed and tuned up, he can operate them in exactly the same manner as the corresponding mechanisms are operated in real life.

There is no hobby in the world to equal Meccano model-building and there is no other hobby that is so full of interest for boys. Only Meccano is good enough for the boy who prides himself on knowing something about machinery, because Meccano is the only constructional system that is based on exact engineering principles.

Send to-day for the Meccano 16-page booklet, or ask your dealer for a copy. This splendid little book tells you all about the wonderful Meccano hobby and contains full details of all Meccano Outfits.



MECCANO PRICES

No. 00 Outfit	3/6
No. 0 ,,	5/-
No. 1 ,,	10/-
No. 2 ,,	16/-
No .3 ,,	27/6
No. 4 ,,	50/-
No. 5 (carton)	65/-
No. 5 (oak cabinet)	95/-
No. 6 (carton)	115/-
No. 6 (oak cabinet)	150/-
No. 7 (oak cabinet)	380/-

ASK TO SEE THE 1929 MECCANO AT YOUR NEAREST TOY SHOP

The Toy that made Engineering famous

MECCANO LIMITED Old Swan LIVERPOOL

The "Lynx-Eye" Competition

A FINE TEST FOR SHARP-EYED MODEL-BUILDERS

THE FIRST CONTEST OF AN INTERESTING NEW SERIES

THIS month we are announcing an entirely different type of competition. It has been termed the "Lynx-Eye" Competition because it affords a searching test of the powers of observation of our readers, although competitors will still find model-building skill an important asset! All that you need when entering this competition are copies of the 00-3 and 4-7 Manuals, a pencil, paper, and a pair of sharp eyes! The task set before you is to find out from which models in the 00-3 or 4-7 Manuals the twelve fragmentary pictures illustrated in the centre of this page have been taken.

The contest marks the commencement of a special series that will be continued through the next three issues of the "*M.M.*" In addition to awarding prizes for the best entries that are received for this and each of the following contests, we are also awarding three special prizes, consisting of Meccano products to the value of £3/3/–, £2/2/–, and £1/1/–, to the three competitors who succeed in solving the greatest number of pictures in the complete series. You should therefore make a special point of entering each contest as it appears, for although you may not be successful in the individual competitions, your total number of correct solutions in all the contests may gain for you one of these special prizes.

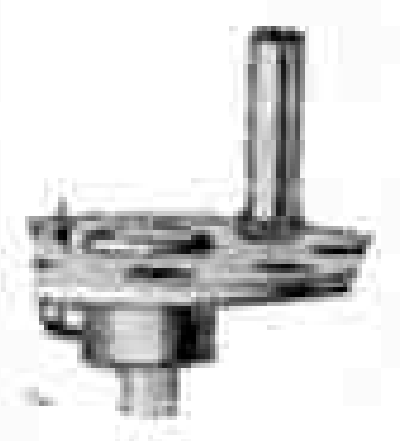


Fig. 1

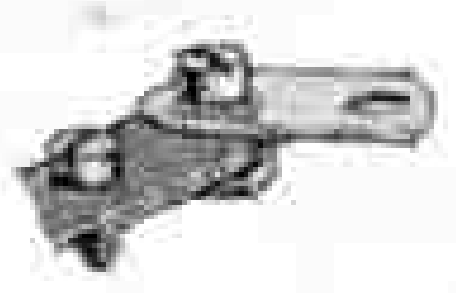


Fig. 2

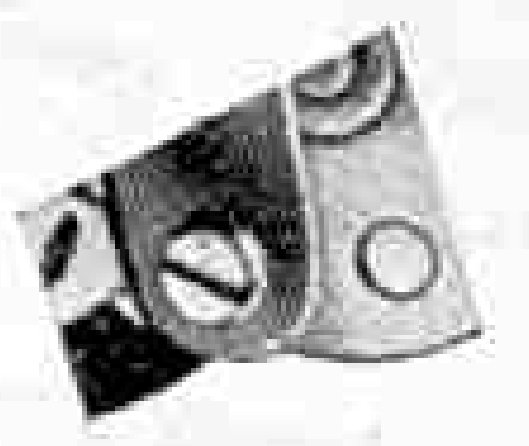
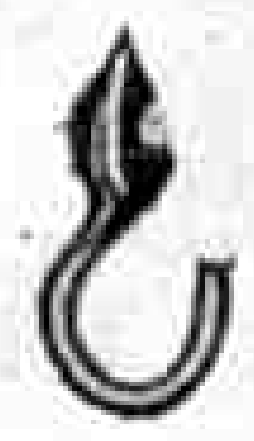


Fig. 3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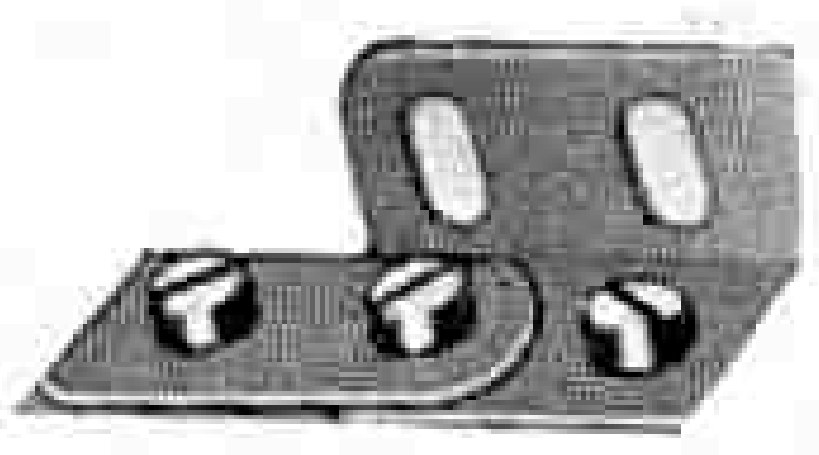
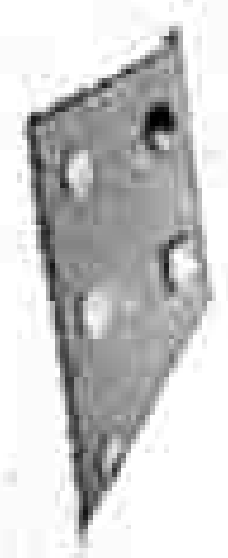


Fig. 5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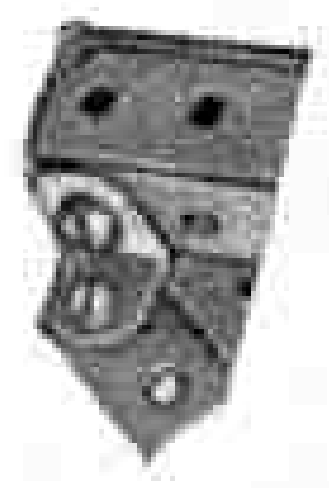


Fig. 7

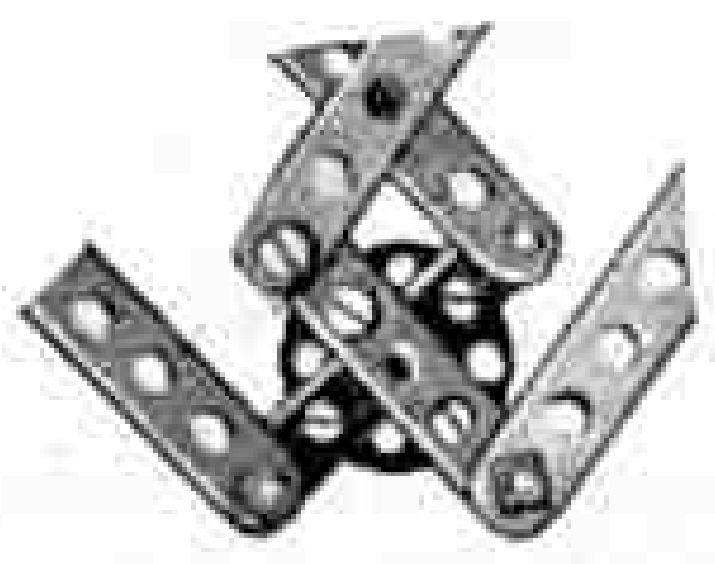


Fig. 8

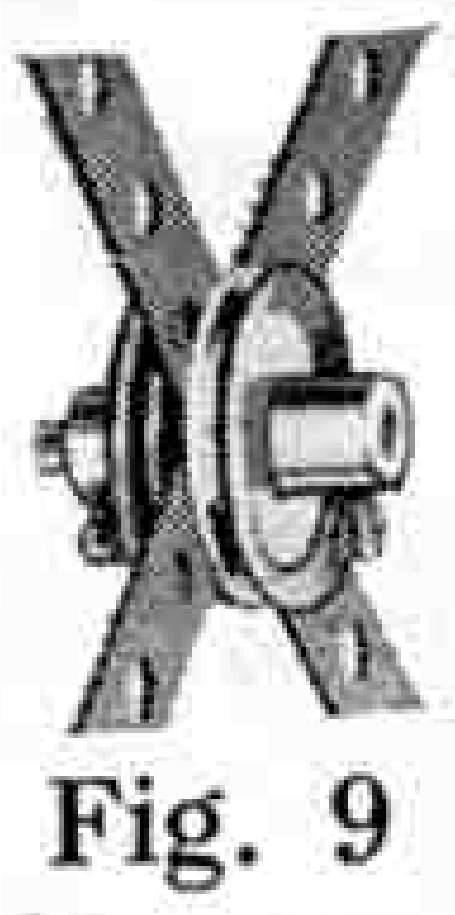


Fig. 9

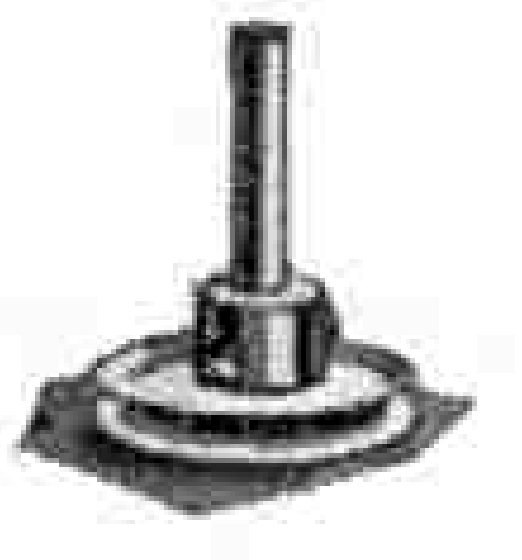


Fig. 10

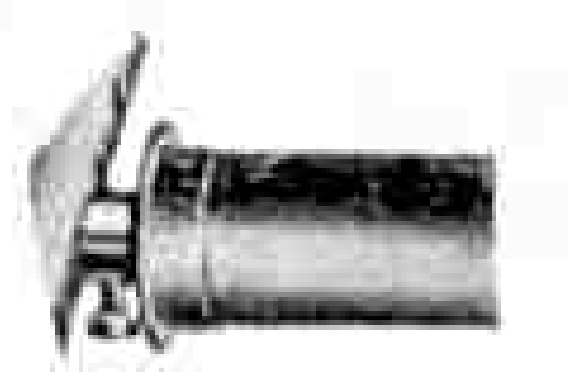


Fig. 11

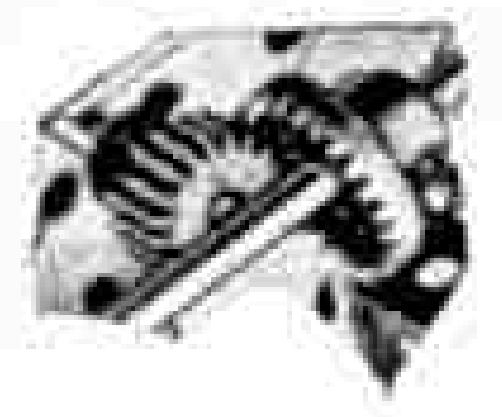


Fig. 12

Do you know your Manuals?

All the twelve pictures illustrated on this page are fragments that have been cut from models to be found in the 00-3 or 4-7 Manuals. What you have to do is to find out from which model each picture has been cut. At first this may appear a difficult task but a careful inspection of the separate models will soon enable you to "spot" from where quite a number of the illustrations have been taken.

The parts shown in the fragments will in nearly every case provide valuable clues in solving the puzzle. If, for instance, the picture contains part of a Coupling or Gear Wheel it can only have been taken from one of the larger models, while if the only parts shown are Pulleys and Strips you may expect to find that the fragment has been removed from one of the more simple models. It should be mentioned that the fragments illustrated have not necessarily been printed in similar positions to those they occupy in the Manuals.

The contest will be divided into two sections—Section A for readers residing in the British Isles, and Section B for readers residing Overseas.

The prizes that will be awarded in each Section are as follows: First Prize, Meccano products to value £1/1/–; Second Prize, Meccano products to value 15/–; Third Prize, Meccano products to value 10/6; Twelve copies of Mr. C. J. Allen's book "*Famous Trains*" and many other consolation prizes will also be awarded in each Section. In the event of more than one competitor solving all twelve puzzles correctly, the prizes will be awarded to the first entries examined.

As you solve each picture you should write down carefully on a postcard first the number of the picture and then the number of the model from which it is taken. The postcard must in addition contain your name, age, and full address, together with the Section in which you are entering. Address postcards "Lynx-Eye" Contest, Meccano Ltd., Old Swan, Liverpool. Entries for Section A must reach this office not later than 31st April, 1929, and for Section B, not later than 30th June, 1929. *Entries must be by postcard only.*

"Simplicity" Model-Building Contest

Model-builders should remember that the "Home" and "Overseas" Sections of the "Simplicity" Contest are still open. The Home Sections close on the 30th April, and the Overseas on the 31st July, 1929, so there is still plenty of time for readers to send in their entries. Full details of the Contest were published in the February and March issues of the "*M.M.*," but briefly the contest is specially intended for models that combine ingenuity with simple construction. There are three Sections, Section A, for Home readers over 14 years of age: Section B, for Home readers under 14 years of age; and Section C for Overseas readers.

All the latest Meccano achievements

New Speed Governing Appliances
New Cranes
New Valve Gears
New Locomotives
New Movements
New Naval Gun
New Ideas

The 1929 Meccano Book of New Models

We have good news for Meccano boys this month—the 1929 edition of the Meccano Book of New Models is ready. This book is brimful of new models and ideas, carefully chosen from thousands of entries in recent competitions. These models are supplementary to the models in the Instruction Manuals, and the majority of them are published for the first time.

All keen Meccano boys should obtain their copies as early as possible so that they may build the new models and try out the new ideas.

How to Obtain the Book

The 1929 Book of New Models may be obtained from any Meccano dealer, price 6d., or direct from Meccano Ltd., Old Swan, Liverpool, price 7d. post free.

There is a special edition for Overseas, price 9d. from dealers or 10d., post free, from the agents (Canadian price—15 cents from dealers or 20 cents, post free, from Toronto).

Readers in Australia, New Zealand, South Africa or Canada who require copies should apply to their dealers or should address their orders to our agencies as detailed below. Readers living in countries other than those mentioned should order from Meccano Ltd., Old Swan, Liverpool, sending a remittance of 10d. with their order.

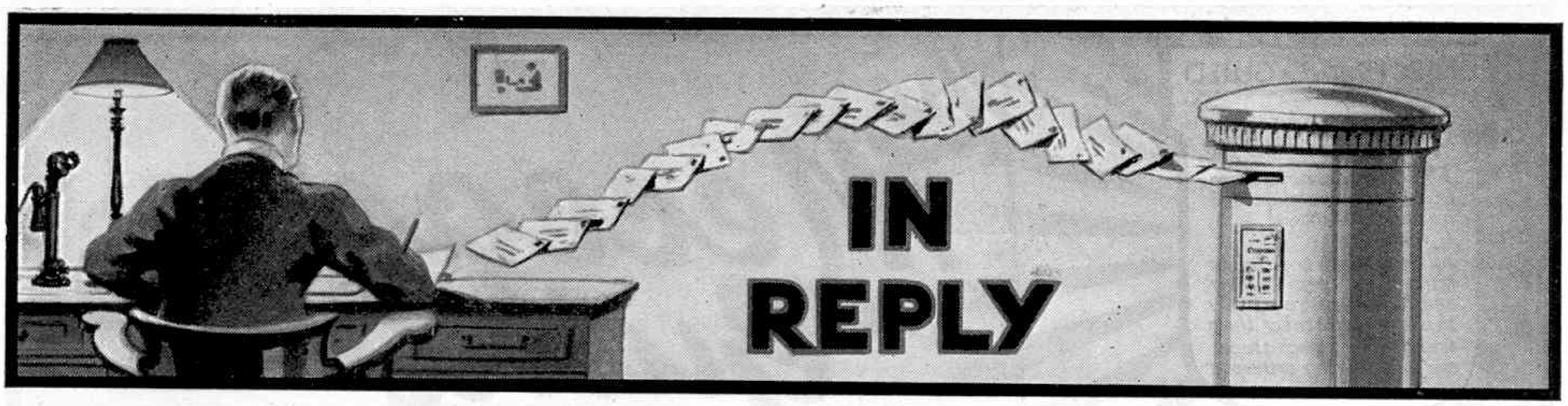
Australia : E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832).

New Zealand : Models Ltd., Kingston Street, Auckland. (P.O. Box 129).

South Africa : Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

Canada : Meccano Ltd., 45, Colborne Street, Toronto.

MECCANO LIMITED, OLD SWAN, LIVERPOOL



In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

Suggested Meccano Improvements

IMPROVED FLAT PLATES.—A slot cut in the Flat Plates would no doubt increase their adaptability slightly, but as the Flat Plates are usually employed in covering in frameworks, and not as bases, we do not think that the slot would be of any real advantage. We will keep the idea before us, however. (*Reply to W. T. Turnbull, Kinsella, Alberta, Canada*).

BOX SPANNERS.—You will be pleased to hear that in the near future we propose to introduce a set of box spanners that can be fitted to the standard screw-driver. Watch the "*M.M.*" for a further announcement. (*Reply to W. J. Wickens, Maidstone*).

1″ DUNLOP TYRE.—We agree that some of the small models included in the 00-3 Manual would benefit by the addition of miniature tyres that would fit over the 1″ Pulley Wheels. We would remind you, however, that the ⅝″ Rubber Rings (Part No. 155), although they do not possess a tread, serve excellently as tyres for the 1″ Wheels. (*Reply to S. Luckin, Horley*).

IMPROVED HINGE.—The present Hinge (Part No. 114) is a very neat accessory, and although the addition of extra lugs would no doubt increase the strength of this article, we do not think this addition advisable, on account of the extra cost and loss of neatness. We are not losing sight of the idea, however, as there is a possibility of a new form of hinge being introduced in the near future. (*Reply to E. M. Edwards, Great Milton*).

IMPROVED SPROCKET WHEEL.—There would be little point in punching four holes in the 1″ Sprocket Wheel. In all models, to our knowledge, this wheel is fixed upon a shaft and serves only to carry Sprocket Chain around its periphery. The four holes would therefore serve no useful purpose. (*Reply to E. M. Edwards, Great Milton*).

LARGER TRUNNION.—The addition of extra length to the flat lug of the existing Trunnion would entirely upset the functions of this part, and the part cannot therefore be altered. A 1½″ Angle Girder bolted to a Flat Trunnion will fulfil your need for an extra large Trunnion. (*Reply to G. A. H. Eckles, Bridlington*).

NEW GEAR WHEELS.—There would not be any demand for gear wheels manufactured without a boss and set-screw, and we do not propose therefore introducing these parts. (*Reply to J. C. L. B. Bailey, Birmingham*).

FRICTION CLUTCH.—We have inspected your drawings of a suggested friction clutch which you consider will be useful in the system. Your clutch would resemble a type that is commonly used on motor cars, and comprises two conical drums which fit into each other. We do not think, however, that it is advisable to introduce it in view of the fact that quite an efficient and realistic clutch can be constructed from standard Meccano parts (see the Meccano Motor Chassis). (*Reply to Alan Mann, Southampton*).

DOUBLE WIDTH GEAR WHEEL.—Your suggestion that the 50 and 57-teeth Gear Wheels should be manufactured double their existing width is interesting. This alteration would no doubt produce smoother running and less wear on the teeth of the wheels, owing to the increased bearing that would be provided. We will endeavour in the near future to carry out experiments with gear wheels of extra width in order to find out whether they possess any distinct advantages over the present Gears. (*Reply to S. Hayes, Chester*).

MILLED KNOB.—We do not consider that there would be a large demand for a special milled knob, if introduced. You mention that a knob of this type would be useful in screw adjustment mechanisms, but we think that there are plenty of other parts already in the system that can be used instead. For example a Pinion or 1″ Gear Wheel should prove useful when a knob is required and they can certainly be relied upon to give a firm grip to the fingers of the operator! (*Reply to F. Grindly, St. Albans*).

IMPROVED AXLES.—By cutting the standard thread for about ¼″ at each end of all Axle Rods, lock nuts could certainly be fitted, and in many models this would mean a great saving of Collars, etc. You point out that the thread would not get in the way when the Axle was journalled in the usual form of bearing as in nearly every case a short length of rod is always left projecting outside the journal. We consider this a good idea and will give it very careful consideration. (*Reply to F. Margerison, Blackburn*).

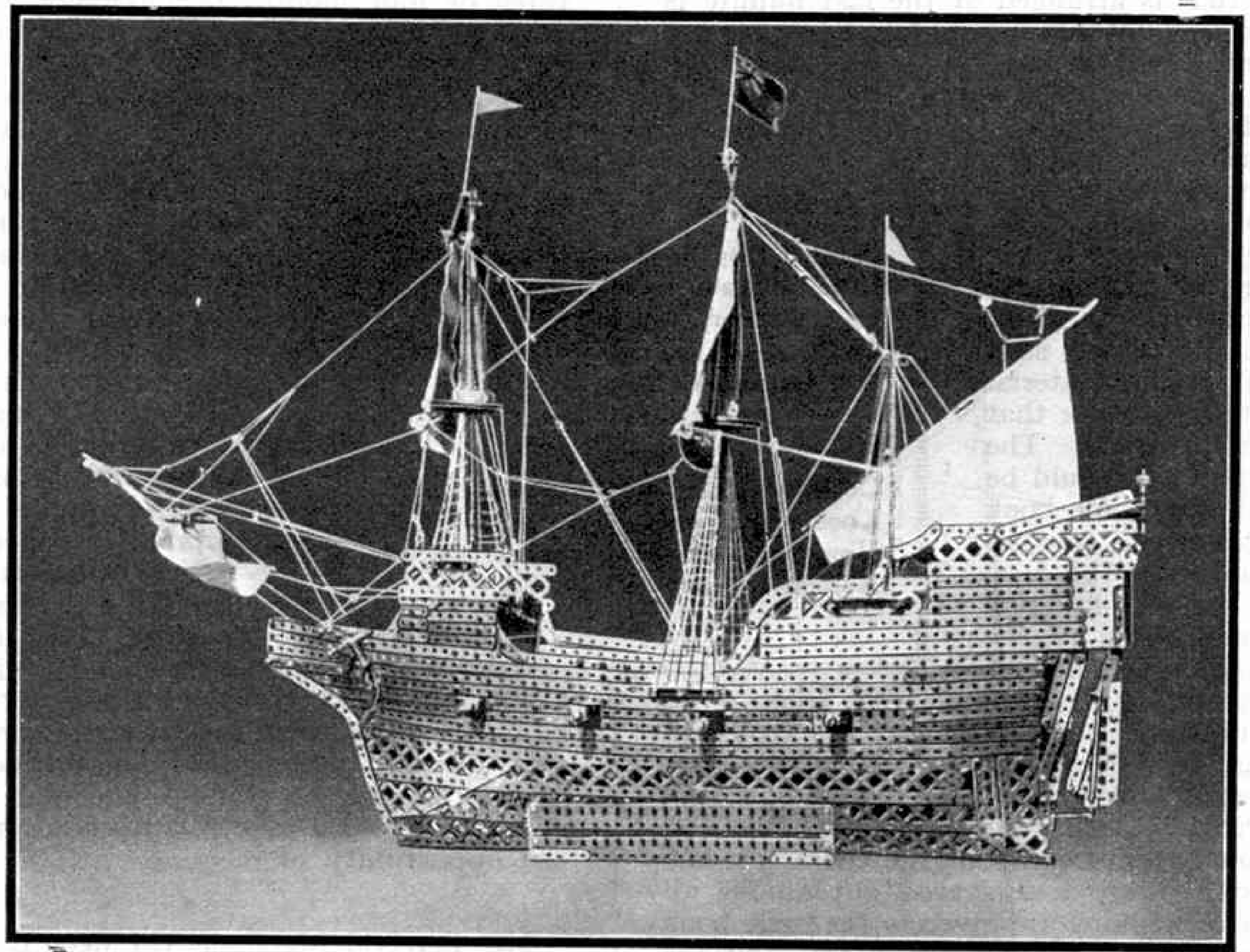
CONICAL DISC.—We were very interested in your design for a conical disc that could be fitted to the 3″ Pulley, thus giving the wheel the appearance of the automobile disc pattern. Your suggested disc would resemble a hollow cone having a hole punched at its centre, and carrying two short screws, secured to the inner surface of the cone. These screws would pass through holes in a 3″ Pulley and the complete cone could thus be secured by nuts. Although this is an interesting idea its use would be very limited, and we do not think that we should be justified in introducing a special accessory so that the 3″ Pulleys could be given the appearance of automobile disc wheels. (*Reply to J. Frampton, Hounslow*).

SPECIAL SPRING.—A special helical spring somewhat larger in diameter than the Spring (part No. 43), and fitted at each end to small perforated plates, would be of little use in the construction of models. You mention that your suggested springs would be employed in preventing vibrations from the road wheels reaching the chassis of a model car, but we would remind you that in actual practice semi-elliptic or cantilever springs are always used and that helical springs are never employed. Excellent examples of chassis springing are to be found in the Meccano Chassis (Model No. 7.1). (*Reply to J. Frampton, Hounslow*).

COMMUTATOR.—We are considering your idea that the commutator fitted to the Electric Motors should be supplied separately and fitted with a set-screw so that it might be secured to the standard Axle Rod. While no doubt a special commutator would be of use in building demonstration models of electric motors from standard parts, it is of course possible to build quite an efficient commutator without using any articles other than those already included in the system. (*Reply to K. Lawson, Hull, and H. Sjogren, Luton*).

FILM SPROCKETS.—We were interested in your suggestion that special Sprocket Wheels that would fit into the "steps" of standard cinematograph film should be introduced. The introduction of these wheels would certainly facilitate the construction of a cinematograph machine, but it is of course impossible for us to say what demand there might be for these wheels if introduced. If we receive a number of requests for these parts, however, we will take steps to introduce them. (*Reply to D. Shanner, Sutton Coldfield and K. Stewart, Newcastle*).

A Further Example of Model Ship Building



Building old time galleons has now developed into quite a craze amongst model builders, and we continue to hear of many constructors using their Meccano to devise exceedingly faithful and artistic reproductions of these historic vessels. The model shown above was constructed by E. Smith of Montreal, and represents "The Mayflower," which in 1621 carried the Pilgrim Fathers to the New World. Those who are able to compare this photograph with an illustration of the original ship will appreciate how cleverly the various details have been reproduced.

While the constructional work is excellent, we are afraid that the Canadian Ensign fitted to the tip of the main mast is not quite in keeping with the other details, as the Ensign was first introduced some 250 years after "The Mayflower" sailed!

OBJECTS of the GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

The Meccano Guild

With the Secretary

Club Holiday Camps

The practice of holding Meccano Club holiday camps grows steadily. Practically all the clubs that have held holiday camps in previous years intend to do so again during the summer, and many other clubs will make their first experiment in this direction. As I have said on many previous occasions, I am strongly in favour of a club camp and, provided the weather is moderately good there is no finer holiday possible.

There are many essential points to be attended to in regard to a camp, but the most important of all is that of thorough preparation well in advance. A camp that is arranged at the last minute is always a failure, and occasionally may be almost disastrous.

The first step is to secure a suitable site. In many cases, the Leader or some member of the club may know of a suitable place, but if not, application should be made to the railway companies, who publish lists of camp sites in the districts they cover. Full particulars should be obtained at the same time in regard to the reduced fares for camping parties, for the amount saved in this manner is very considerable. Having secured a site, the next thing is to make a list of all the material that will be required, and this is a task that should be done very carefully indeed. The experience of members of the club should be supplemented by consultation of some book on camping. It is not necessary to buy an expensive book and, as a matter of fact, one of the most practical books I know is "*The Camper*," by "Nomad," one of the series of "Recreation" books published at 6d. each by Frederick Warne & Co., Ltd. The advice in this book is brief, but it is thoroughly practical and may be regarded as a safe guide in every respect.

A Meccano Club Rhyme

Made by boys to show that they
Excel in neatness every way.
Careful fingers, nimble brains,
Construct our engines, boats and 'planes.
All together with good will,
Never stopping work until
Our magic models fill the bill.

Come and see our yearly show
Look around, and, ere you go
Upon your way from pleasure's hub,
Become a member of our club.

Percival Marshall

The success of a camp depends to a very large extent upon the quality of the cooking. Provided that the meals are planned on simple lines, there is not much difficulty about the cooking if the various tasks connected with it are well shared out among all the members. Useful hints on cooking are given in the little book to which I have just referred, but those who are more ambitious or perhaps a little nervous as to the success of their efforts, will do well to study "*Camp Cooking and Catering*," by Major J. T. Gorman, published by Brown, Son & Ferguson Ltd., of Glasgow, at 2/6.

Funds for Excursions

Many clubs find themselves unable to arrange to spend a week or a fortnight under canvas, and the alternative is then to arrange excursions to places of interest. These visits, of course, involve a little expense, and while some clubs are fortunate enough to be able to meet the expenses out of funds, it is more often the case that each member must pay his own expenses at the time. In order to simplify this, it is an excellent plan to commence an "Excursions Savings Bank." All members who intend to take part in excursions pay into this bank every week a certain sum—the amount being decided by each one personally—and thus is built up a reserve that each member may draw upon when the time for an excursion arrives.

One or two clubs have gone even further than this and instituted a permanent savings bank. In the winter months this bank proves extremely useful to members in the purchase of Meccano parts or Hornby Train material.

Correspondents Wanted

The Guild Correspondence Club not only continues to grow, but does so at such a rate that at times I find it exceedingly difficult to supply all demands. One curious and interesting feature that I have noticed in regard to this club during the past few years has been that the demand for correspondents in certain particular parts of the world comes at intervals in a sort of wave. For example, for three or four months in succession there may be a tremendous demand among English members for correspondents in South Africa, and then some delay is bound to occur in fixing up everybody satisfactorily. Then South African correspondents apparently go out of fashion, for the demand is all for Australian boys!

Why this should be so I do not understand, and I think all members will realise that these sudden demands for one country are not easy to deal with. For this reason I hope that all new members will give me one or two alternative countries in addition to the one in which they chiefly desire a correspondent. If this is done, I can usually find an interesting correspondent immediately, so that interest is maintained in the interval that sometimes elapses in finding a really suitable correspondent in the desired country.

Guild members who have not yet joined the Correspondence Club should seriously consider doing so at once, for interesting correspondents in all parts of the world are waiting for them. There is nothing more pleasant than to exchange news with someone living in a far-off part of the world where conditions are utterly different, and by means of photographs real personal friendships spring up, in spite of the fact that the two correspondents may never have the opportunity of meeting.

* * * *

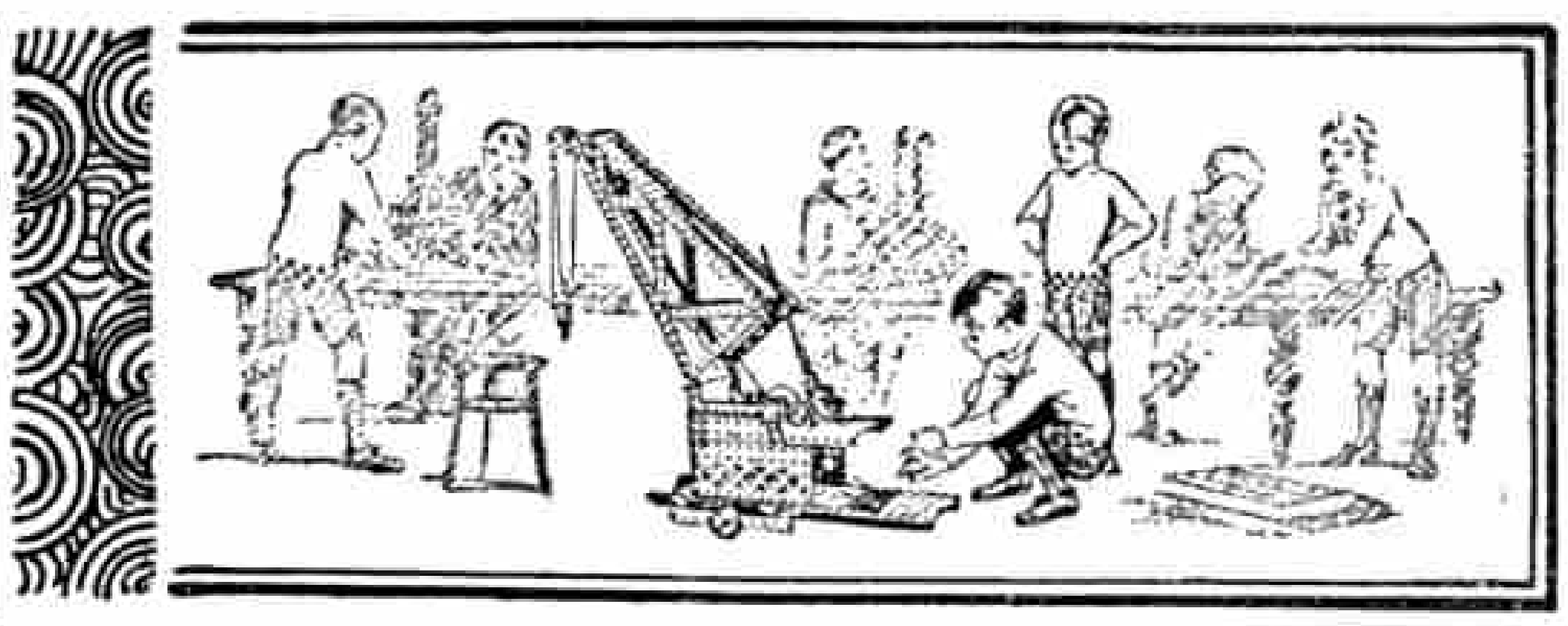
Mr. Percival Marshall, C.I.Mech.E., the well-known Editor of "*The Model Engineer*," very kindly judged the entries in the Model-building Competitions held in connection with the tenth Annual Exhibition of the Holy Trinity (Barnsbury) Meccano Club. He was greatly interested in the work he saw, and before leaving he wrote in the club Visitor's Book the witty lines printed in the centre of this page. These lines summarise in a very happy manner the pleasures of Meccano Club life.

Proposed Clubs

Attempts are being made to form Meccano clubs in the following places and boys interested in becoming members should communicate with the promoters, whose names and addresses are given :—

BARNSTAPLE—R. H. Holland, Little Pill, Bishop's Tawton, Barnstaple.
BRIGHTON—J. P. Assenheim, 102, Kings Road, Brighton.
CORNWALL—Mr. R. Barbary, School House, St. Ewe, Mevagissey.
HUDDERSFIELD—D. Haigh, "Glenroyd," Triangle, Paddock.
NEWTOWNARDS—W. Stewart, 1, Cairns Villas, Victoria Avenue.
SCARBOROUGH—G. Corbridge, 27, Garfield Road, Scarborough.

CLUB NOTES



Lichfield Central School M.C.—Model-building Nights and Games Evenings arouse the greatest interest. Members are very keen on Competitions of all kinds, and these are invariably well staged. The Leader, Mr. S. P. Hughes, B.Sc., A.I.C., who is Science Master of the School, gave a Lecture on "*Stars and Planets,*" which was greatly enjoyed. Club roll : 13. *Secretary* : W. Johnson, 58, Beacon Street, Lichfield.

Lincoln M.C.—Has been handicapped by the illness of the Leader, Mr. J. Batters, but the secretary reports that he has now fully recovered. Membership is increasing and the club is now firmly established. The programme includes an Exhibition, Hornby Train Evenings, Papers by members, and a Story Night. A debate on "*Should Lincoln Tramcars be Abolished?*" provoked a fierce discussion. The Leader gave a very interesting talk on "*The Microscope*" and illustrated it with the aid of a powerful instrument of the latest pattern. Club roll : 30. *Secretary* : H. Sleightholme, 33, Milton Street, Lincoln.

Lochgilphead M.C.—A recent Model-building Night was devoted to the construction of Motor Lorries. Their steering gears were severely tested on a hairpin-bend chalked on the floor. A Motor Show, at which models will run on chalked roads, is now being planned. Club roll : 13. *Secretary* : Ian McCallum, Duncraoibhan, Lochgilphead, Argyll.

Bridport Grammar School M.C.—The Leader and 14 members paid a visit to Messrs. Gundry's Networks, the largest in England. Model-building is the greatest interest of members, who are now busy on a series of original models. Club roll : 25. *Secretary* : E. Lawrence, 161, St. Andrews Road, Bridport, Dorset.

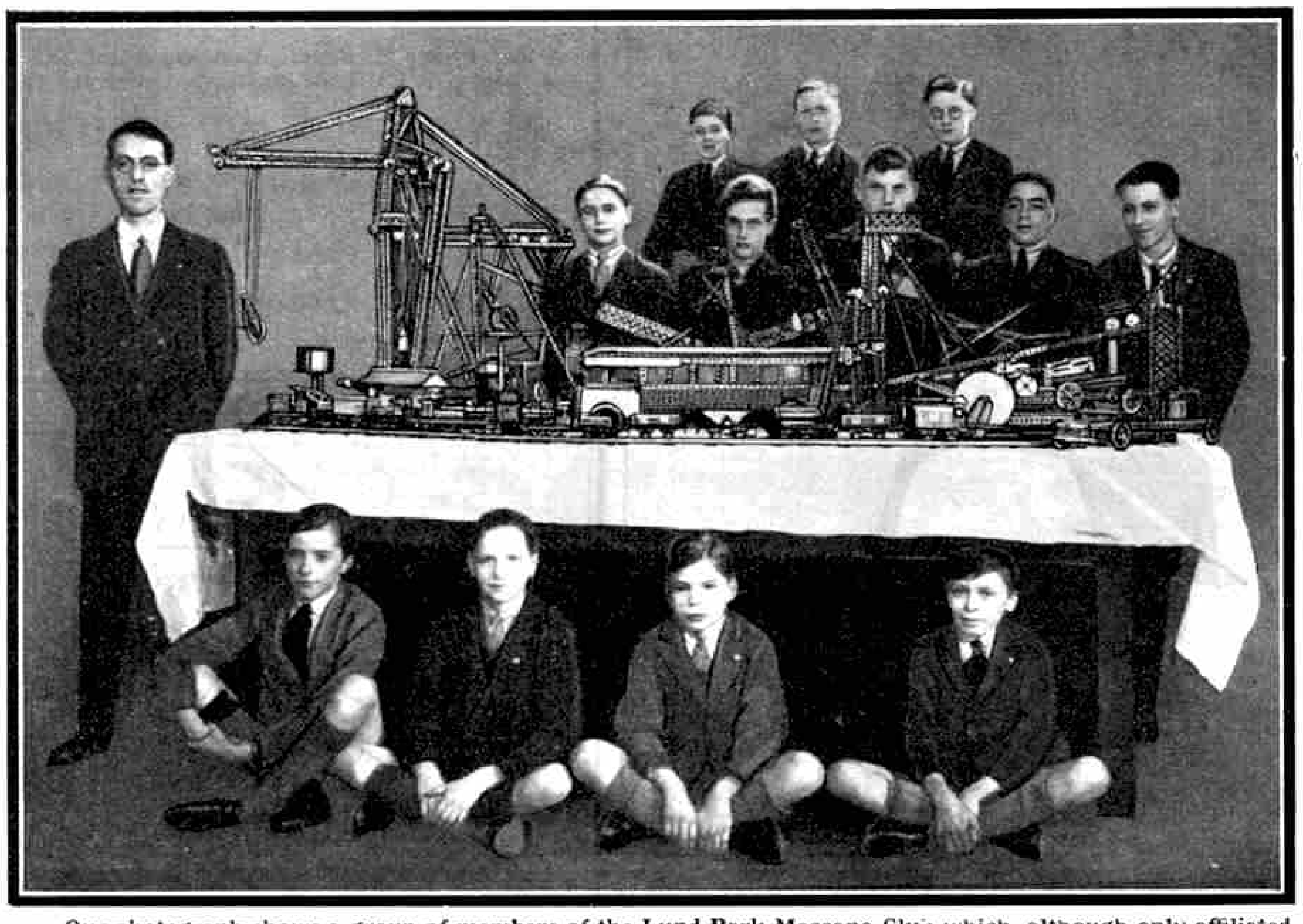
Northwood M.C.—Has arranged an excellent programme that includes Model-building, Lantern Lectures, Debates, and Games. Special attractions are "Mystery" and "Camp Fire" evenings. A Display is being planned for April, and members are building special models for the occasion. A large Railway Layout also will be on view, and a Conjuring Entertainment will be one of the many attractions. A novel feature will be a Bookstall, which will be supplied and carried on by a local stationer. Club roll : 15. *Secretary* : Alan S. Whiddington, "Pencarrow," Sandy Lodge Way, Northwood.

Newcastle-on-Tyne M.C.—A varied syllabus has been drawn up and includes Model-building, Lectures, Contractors' Nights, and Games and Visitors' Evenings. An invitation was issued to all Meccano boys in the district to enter models for the recent Exhibition. Members are urgently needed and the Leader will be very pleased to hear from any boy who wishes to join. Leader : Mr. B. Gilbey, 804, Walker Road, Newcastle-on-Tyne.

St. Peter Mancroft (Norwich) M.C.—A talk on "*Ships*" and a Debate on "*Aeroplanes versus Ships, as a Means of Transport and in Warfare,*" aroused great interest. The Debate was particularly keen, the champions of Aeroplanes losing by one vote. Miss A. E. Steward, Vice-President of the club, has commenced a series of talks on her "*Cruise in the Mediterranean.*" A successful Gramophone Night has been held and arrangements for a Concert are now well in hand. Club roll : 60. *Secretary* : J. Vyse, 51, Cardiff Road, Norwich.

Victoria (Glasgow) M.C.—Models shown at the seventh Annual Exhibition included a two-cylinder Steam Engine loaned from Headquarters, a Jacquard Loom and a Stone Crusher. The two last-named models were constructed by members, and goods trains on the Hornby Train Layout also on view were kept busy supplying the Stone Crusher with material. Good use was made of the club printing machine, and leaflets printed during the Exhibition were distributed among visitors. The profits amounted to the satisfactory sum of £3 13s. 0d. Club roll : 50. *Secretary* : R. Hannah, 26, Kennedy Drive, Partick, Glasgow.

Lund Park (Keighley) M.C.



Our photograph shows a group of members of the Lund Park Meccano Club which, although only affiliated in October last, has made rapid strides under the able Leadership of Mr. J. H. Dobbs, who is seen standing on the left. The energetic secretary, H. S. Holmes, is on the right of the back row. Model-building forms the club's main activity, and the fine models shown are a selection from those on view at a recent exhibition.

King Edward's High School (Birmingham) M.C.—A very interesting talk on "*Printing*" was given by a member, who exhibited samples of type. A Model-building Contest attracted many excellent models including a Penny-in-the-slot Chocolate Machine, a Stationary Engine, and a Tractor. The club has a large model railway with five stations. On Hornby Railway Nights operations usually are conducted with 10 engines, 15 passenger coaches and 46 goods wagons. Club roll : 16. *Secretary* : David H. Lewis, The Mount, Bilston, Staffs.

Wimbledon M.C.—Is making splendid progress. The excellent programme drawn up includes a Lecture on "*Locomotives*" by an Engineer connected with the Southern Railway, and a visit to the Science Museum at South Kensington. A Recruiting Campaign has been organised and several new members have already been enrolled. Club roll : 18. *Secretary* : M. O. Carroll, "Dairin," Drax Avenue, Wimbledon, S.W.20.

Wallisdown M.C.—At one interesting meeting a Motor Chassis loaned from Headquarters was demonstrated and explained by the Leader. This model also figured at the club's Exhibition. Wood Carving is to be adopted as an additional hobby, and it is intended to make it a source of income. Club roll : 12. *Secretary* : E. J. Hoddinott, Bryants Cross, Wallisdown, Bournemouth.

Dunoon District M.C.—A visit was paid to the local Gasworks. The Manager kindly conducted the party round, and explained everything in detail. Contractor's Nights and Railway Evenings have been very successful, and an interesting lecture on "*Football*" was followed by a keen discussion on tactics. Club roll : 16. *Secretary* : W. D. Laird, "Parkroyd," Victoria Road, Dunoon.

Blackpool M.C.—Recent meetings have included a successful Model-building Contest, in which prizes were awarded for the most novel productions ; and a series of talks of the "How to Make" kind. "*Soldering,*" "*Uses of a Blow Lamp,*" and "*How to make a Motor Boat*" were among the subjects of these, and members were greatly interested in the practical demonstrations given. Club roll : 11. *Secretary* : W. Connor, 266, Waterloo Road, Blackpool.

Cecil Road (Gravesend) M.C.—Each Model-building Night is devoted to the construction of models of special character. At one meeting models of Fire Engines and other Fire-fighting apparatus were built. All turned out to a mock fire that very conveniently broke out immediately after they had been completed. In the excitement an unfortunate accident occurred—one of the members sat on a Fire Engine ! Locomotive and Machinery Nights have been conducted on similar lines, all models constructed being put to practical use. Locomotives were tested on a track built with Meccano parts, and the Lathes, Drills, etc., built on Machinery Night were installed in a workshop, and driven by Steam Engines and Clockwork Motors. Club roll : 20. *Secretary* : G. N. Cottle, 53, Cecil Road, Gravesend.

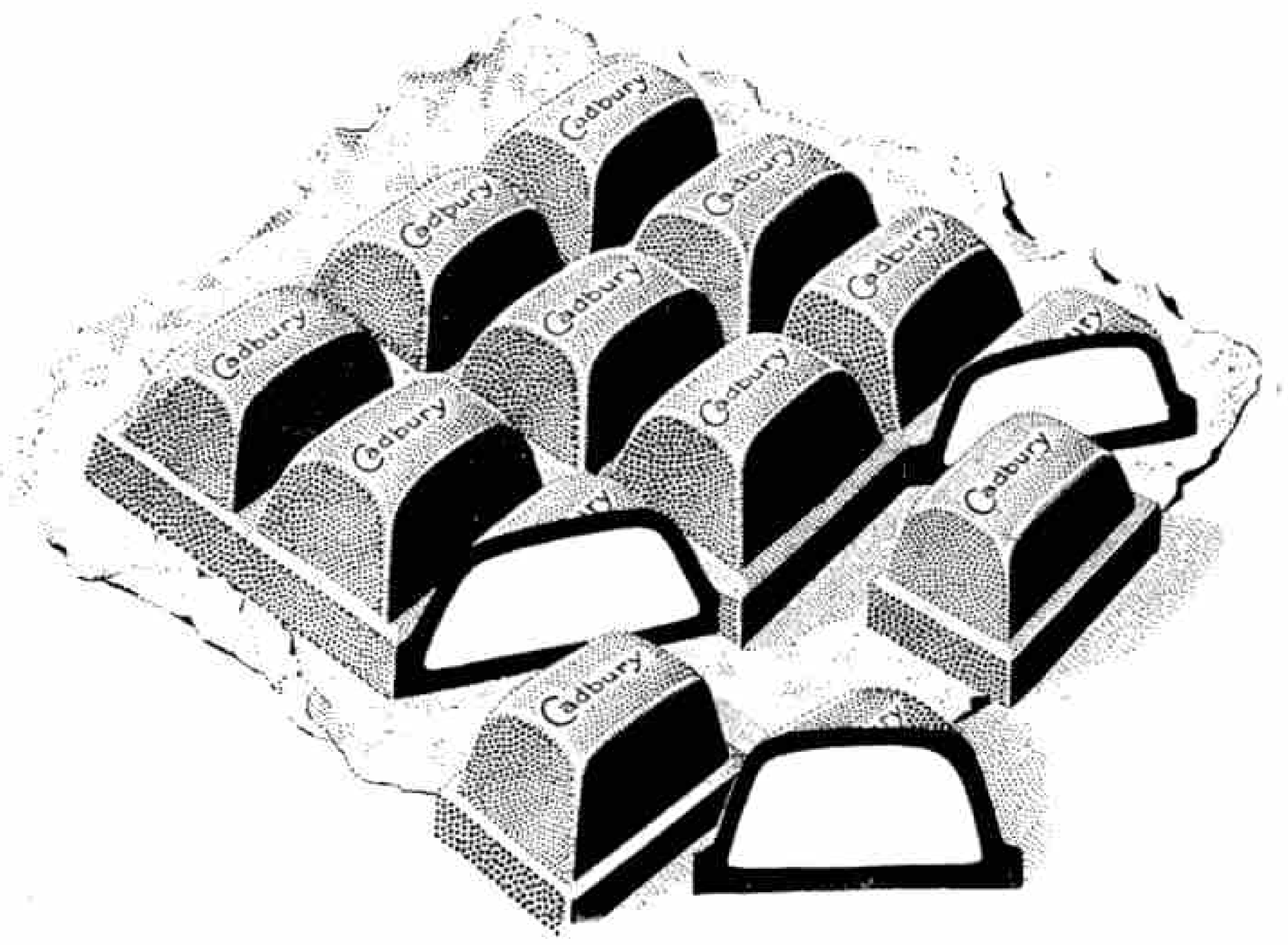
Oundle M.C.—Excellent lectures on "*Aviation*" and "*Aircraft Training*" have been given by Mr. W. Batt, and the Leader is now giving a series of interesting talks on "*Exploration.*" A Debate on "*Horses v. Motors*" ended in victory by one vote for the supporters of motors. The Exhibition was a great success. A sum of 14/9 was raised, which is very satisfactory for a first effort. Among the splendid models exhibited was a Ship Coaler on loan from Headquarters, and a popular competition was arranged in which entrants were required to guess the number of parts used in building it. An interesting event was a special Games Night when each member brought a friend with him. Club roll : 15. *Secretary* : E. J. Straw, Ewelme, South Road, Oundle.

Parkstone M.C.—Attendance has been good and several new members have been enrolled. The club has been divided into three sections, and points are being given for model-building and attendance in monthly contests. Members are still greatly interested in Electrical work and experiments. Club roll : 20. *Secretary* : Eric Bath, 165, Ashley Road, Parkstone, Dorset.

Plymouth M.C.—The Exhibition was an outstanding success. Visitors were greatly interested in the splendid models on view, and the efficient manner in which their working was demonstrated by members is favourably mentioned in a report in the local newspaper. A series of talks on "*The Progress of Transport*" are being given by Mr. H. Shapcote, M.A. Club roll : 25. *Secretary* : K. Wills, 8, Beechwood Avenue, Mutley, Plymouth.

Cadbury's

Chocolate Sandwiches



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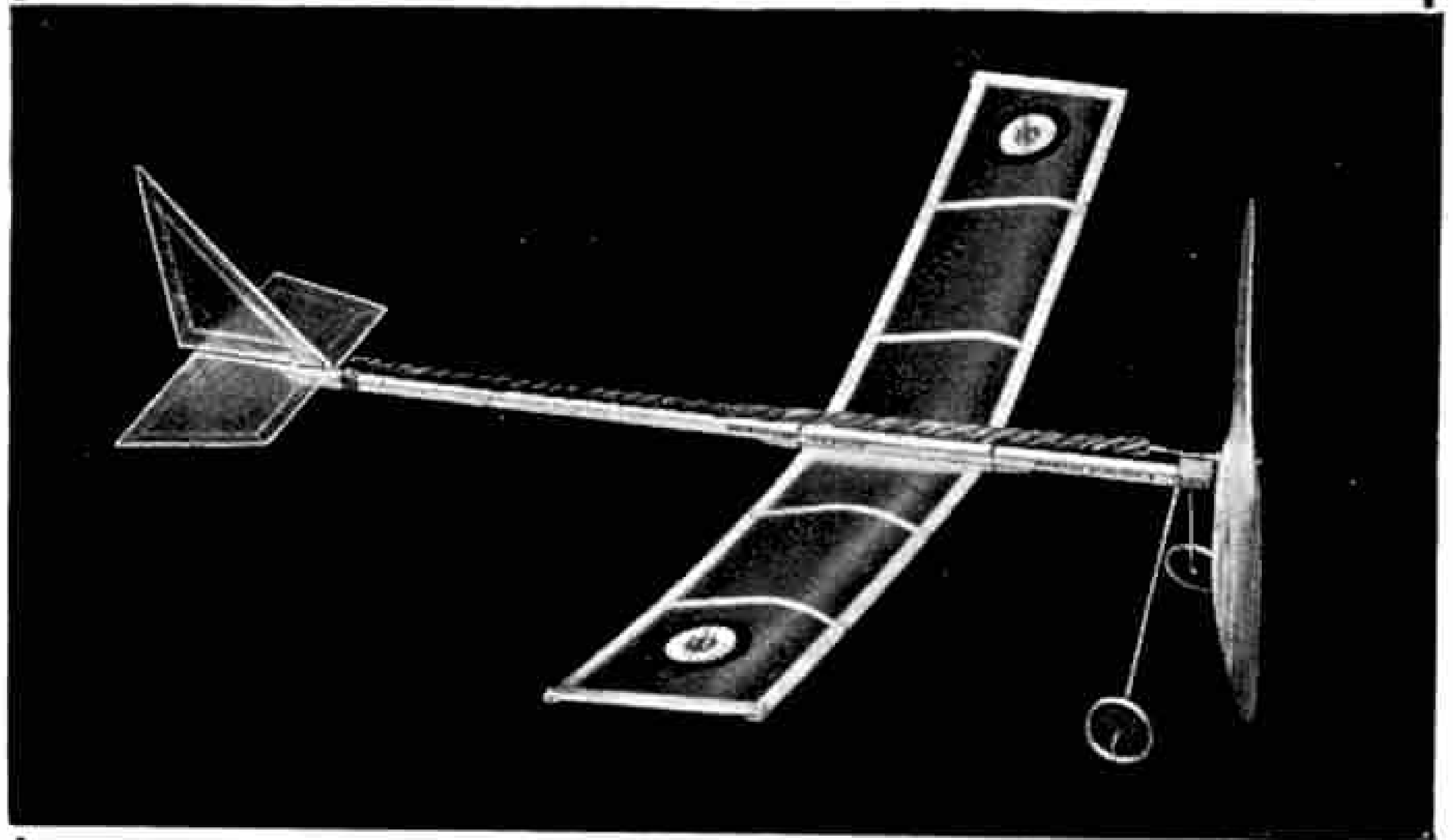

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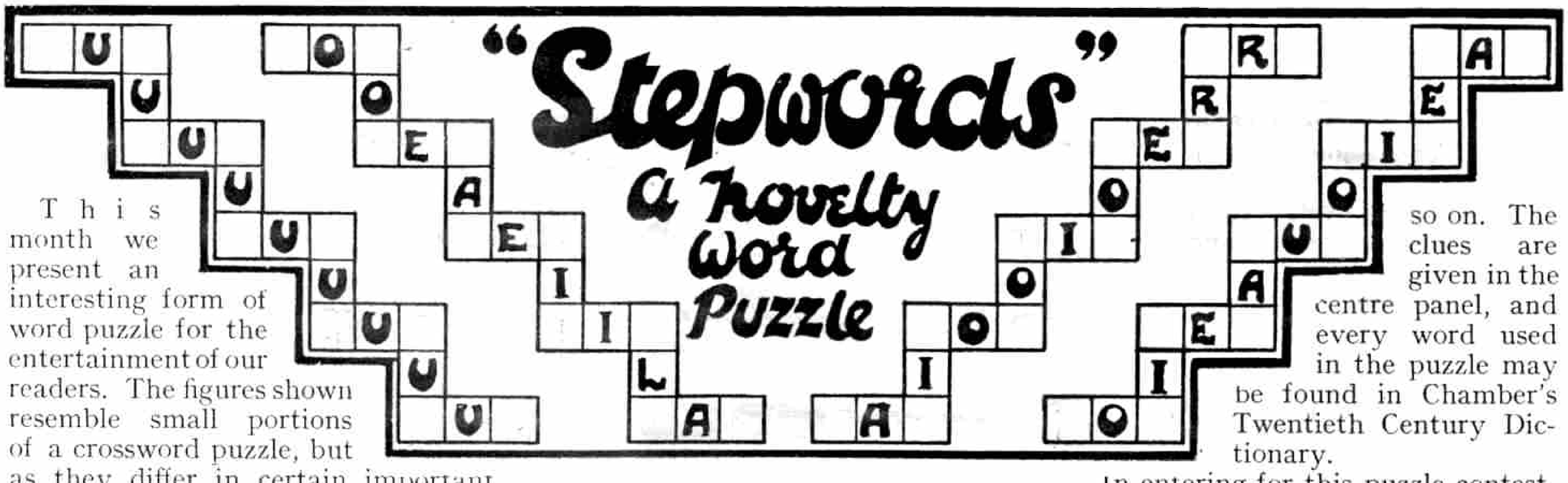
Competition Page



This month we present an interesting form of word puzzle for the entertainment of our readers. The figures shown resemble small portions of a crossword puzzle, but as they differ in certain important points, we prefer to coin a new word and call them "Stepwords."

In the first place, it will be noted that each step has three letters, and that the clues are not numbered. In addition the clues are not arranged in order of the various steps; that is to say, the first clue on the list does not necessarily relate to the word in the first step, but may relate to any step. The middle letter of each word is given, and the problem consists in fitting letters and clues together so that the tops and fronts of each step in the flights are formed by ordinary dictionary words. The given letters must not be moved from the steps on which they appear.

The puzzles run in order across the page; that is, the left-hand puzzle is No. 1, the next is No. 2, and so on. The clues are given in the centre panel, and every word used in the puzzle may be found in Chamber's Twentieth Century Dictionary.

In entering for this puzzle contest, readers should not cut the design from the page. The designs should be copied on a sheet of paper, and the solutions then worked out.

Prizes of Meccano Parts or Hornby Train Accessories (to be chosen by the winners) to the value of £1/1/-, 15/-, 10/6 and 5/- will be awarded to the senders of the first four correct solutions in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes. Entries must be addressed to "Stepwords, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 30th April. Overseas, 31st July. The competitor's name and address must appear on the back of each sheet of paper used.

CLUES

No. 1	**No. 2**	**No. 3**	**No. 4**
Shoot	Fairylike	Spot	Sheep
Confer	Plaything	Peak	Fresh
Bath	Jolly	Fault	Cheat
To pound	Bother	Extremity	Fruit
Knot	Tree	Time	Exquisite
Useless	Connection	Shoot	Colour
Eatable	Destiny	Juice	Point
Fruit	Humorist	Beverage	Solicit
Pigeon	Fasten	Small Drink	Boy's Toy

39th Photographic Contest

The coming of Easter may be said to mark the opening of the popular photographic season. With this first outdoor holiday of the year, thousands of cameras that have lain neglected all through the winter, are remembered and brought from their hiding places, and once more set to their task of recording days of happiness.

Eastertime photography is almost always miscellaneous in character. It is not taken too seriously, and anything of interest that comes along is snapped. For this reason we do not impose any limitations in this contest, but leave the choice of subject entirely to the competitor.

Any type of photograph is eligible for the contest, and we only make the one condition—that each entry should be given a title. In awarding the prizes the appropriateness of the title will be taken into consideration.

The entries will be divided into two sections as usual—A for those aged 16 and over, B for those under 16. Cash prizes of £1/1/- and 10/6, respectively, will be awarded to the best and second best entries in each section, and in addition there will be a number of consolation prizes of a half-crown each. Every competitor must write his name, age and address on the back of each of his prints, which will be returned if a stamped and addressed wrapper of suitable size is forwarded with the entry.

The closing date for home entries will be 30th April; Overseas, 31st July. All entries must be addressed to "39th Photographic Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool."

COMPETITION RESULTS

HOME

Pet Story.—1. C. Holt (Enderby); 2. L. S. Davy (Davington, Kent); 3. L. J. Davey (Leicester); 4. N. Valentine (Bradfield St. George, Suffolk). Consolation Prizes: J. Fyson (Northampton); L. Broadley (Batley, Yorks.).

38th Photographic Contest.—Group 1. First Prizes: Section A, L. Ibbotson (Chadderton); Section B, R. Richardson (Bolton). Second Prizes: Section A, L. Lacey (St. Leonards-on-Sea); Section B, O. H. Woodforde (Baldock, Herts.). **Group 2.** First Prizes: Section A, H. Henshaw (Bolton); Section B, J. MacFarlane (London, S.E.20). Second Prizes: Section A, K. E. Cooper (Ilford); Section B, S. E. Thomson (Edinburgh).

Crossword Puzzle.—The continued popularity of crossword puzzle competitions was reflected in the big entry to this competition. We cannot publish the solution yet as the Overseas Section is still open, but the completed design will appear as early as possible. Prizewinners:—1. N. L. Harrison (Sheffield); 2. E. M. Padwick (Eastbourne); 3. W. J. Courtis (Hounslow); 4. M. H. Cope-Proctor (Worthing). Consolation Prizes: L. Medlin (Par, Cornwall); L. Ayton (Redcar); H. T. E. Owen (Coventry); H. M. Innes (Warminster); J. Mitchell (Edinburgh); M. Wrigley (London, W.1); A. R. Mathaei (London, N.W.8); P. Rackstraw (London, N.W.3).

27th Drawing Contest.—The outstanding feature of this competition was the splendid black and white drawing that gained the first prize in Section B for A. Johnston of Dunstable. This is one of the best drawings by a boy aged less than 16 that it has been our pleasure to see. We intend to publish it in the magazine at the first convenient opportunity. The prizes were awarded as follows:—First Prizes: Section A, O. A. Kimmings (East Acton, W.3); Section B, A. M. Johnston (Dunstable). Second Prizes: Section A, C. Ward (Stockport); Section B, S. J. Gibbs (Winchester). Consolation Prizes: N. Hulbert (Trowbridge); L. Reid (Southampton); G. Sale (Kimberley); R. J. Shepherd (Edinburgh); R. Smithson (Leeds); L. White (Glasgow).

OVERSEAS

November Painting Contest.—First Prizes: Section A, Miss G. Bettesworth (Camps Bay, C.P., S.A.); Section B, MacL. Morgan (Sydney, N.S.W.). Second Prizes; Section A, S. Kewley (Toronto); Section B, D. MacDonald (Sydney).

Word Building Competition.—First Prizes: Section A, E. Worthington (Vancouver, B.C.); Section B. M. Rankin (Melbourne). Second Prizes: Section A, S. F. Desai (Navsari, India); Section B, A. Wilde (Ontario).

My Favourite Bridge.—First Prizes: Section A, A. G. Cooke (Seremban, F.M.S.); Section B, J. Cooper (Toronto, Ontario). Second Prizes: Section A, S. F. Desai (Navsari, India); Section B, E. Smith (Montreal).

Sketchograms No. 2.—First Prizes: Section A, Miss G. Bettesworth (Cape Town, S.A.); Section B, A. Ryland (Christchurch, N.Z.). Second Prizes: Section A, J. G. Guanadurai (Trichinopoly); Section B, S. S. Reuben (Bangalore City, S. India). Consolation Prize: J. Mitchell (Kuala Lumpur, F.M.S.).

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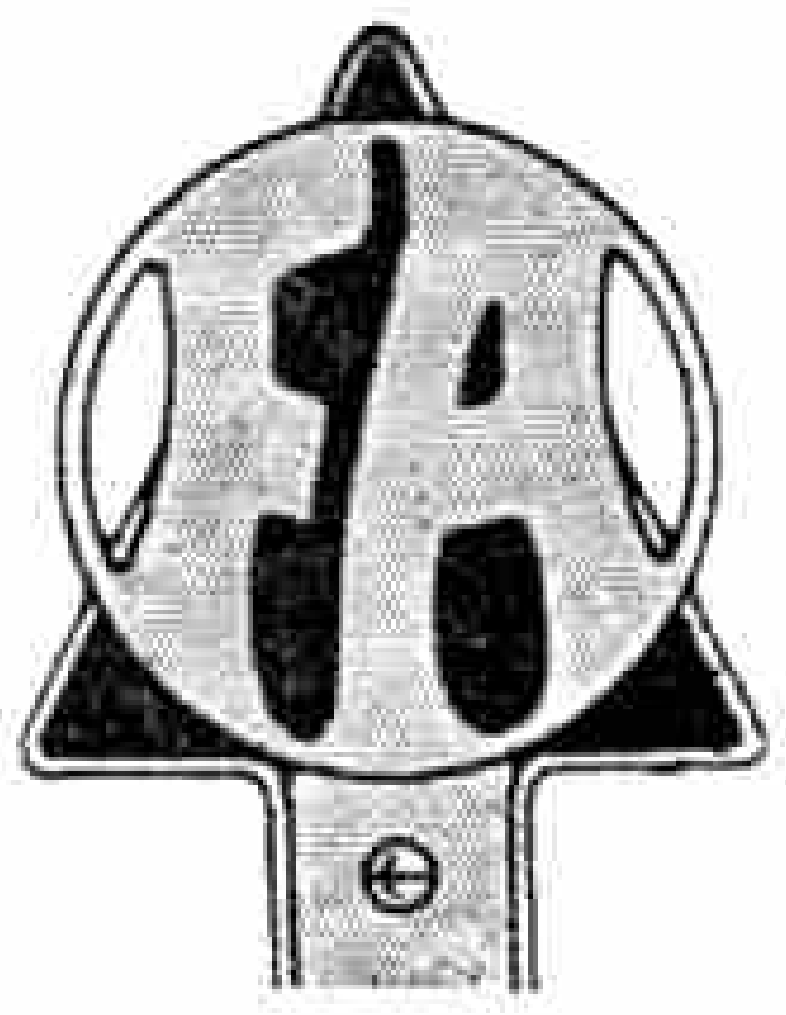

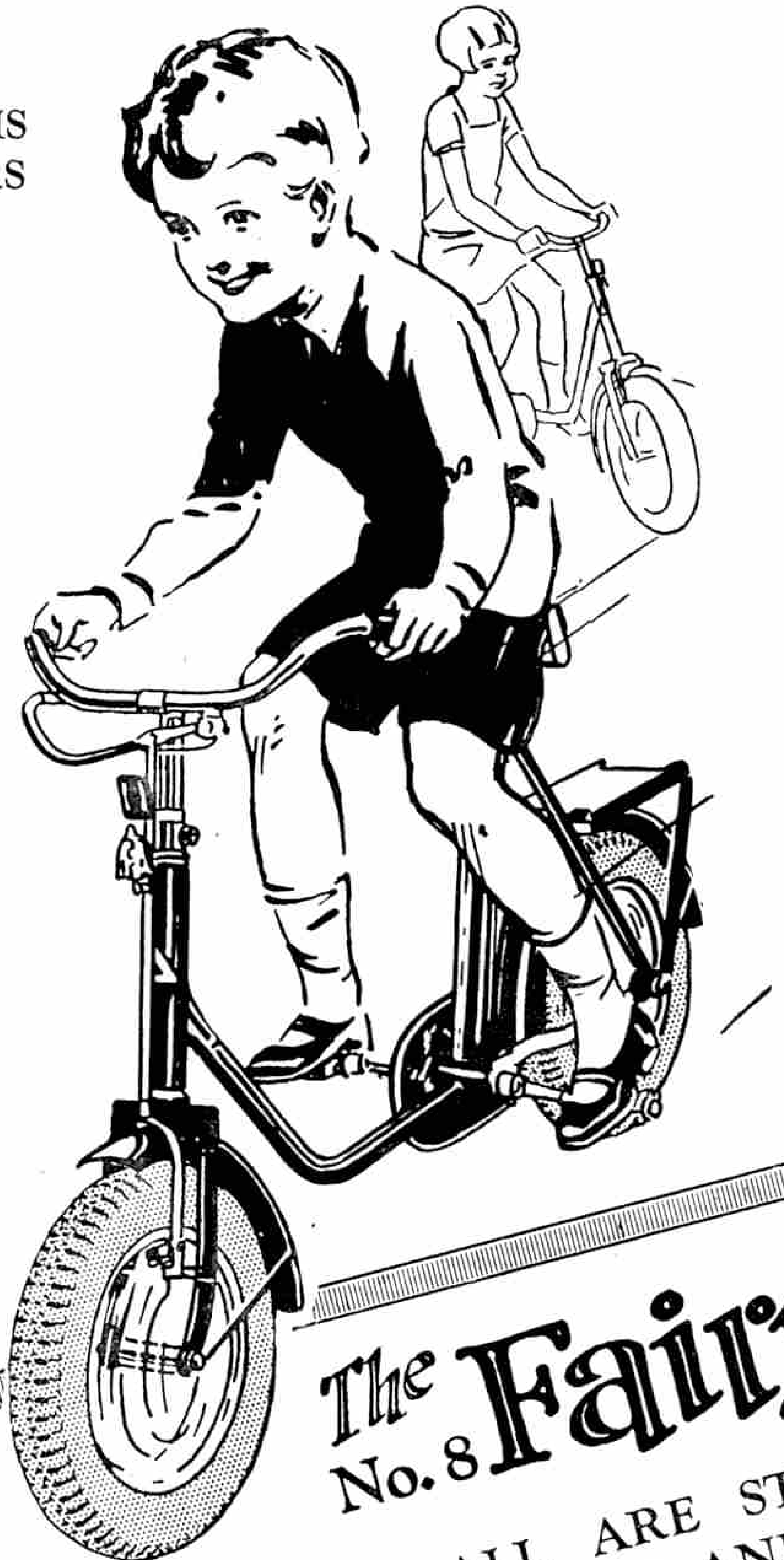

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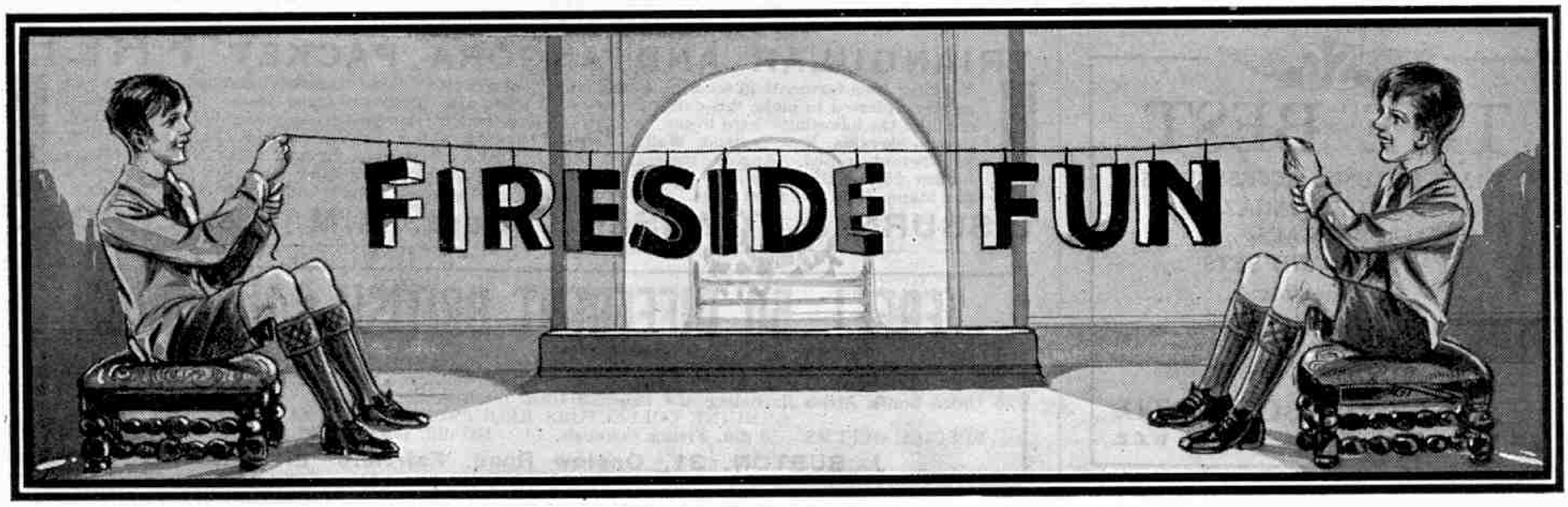


WHAT IS A "SLEEPER"?

A sleeper is one who sleeps. A sleeper is the name of a carriage on the railway in which a sleeper sleeps. A sleeper is the name of a baulk of wood that holds the rails on which the sleeper runs while the sleeper sleeps. Therefore, while the sleeper sleeps in the sleeper the sleeper carries the sleeper over the sleeper under the sleeper until the sleeper which carries the sleeper jumps the sleeper and wakes the sleeper in the sleeper by striking the sleeper under the sleeper on the sleeper and there is no longer any sleep for the sleeper who was sleeping in the sleeper on the sleeper.

L.M.S. Magazine.

* * * *

"Yes, doctor," said the patient, "I've been suffering like this for a long time. I consulted the chemist —"

"You consulted the chemist?" exclaimed the doctor. "Good gracious, man! You surely know chemists always give the wrong advice. What did he tell you to do?"

"He told me to come to you," said the patient.

* * * *

"What are you crying for, my little man?" an old gentleman asked a small boy, who appeared to be much upset.

"Please, sir," replied the boy, "I've been playing truant all day, and I've just remembered it's Saturday."

* * * *

Footpad: "Get ready to die. I'm going to shoot you."

Victim: "Why?"

Footpad: "I've always said I'd kill anyone who looked like me."

Victim: "Do I really look like you?"

Footpad: "Yes."

Victim: "Then shoot, man, shoot!"

* * * *

SUBTLE SARCASM

"Yes, I'm a futurist painter," bragged a young man at a social gathering.

"I'm not much good at painting, either," commented a listener.

* * * *

A lady was making a collection in a mission room. She held out the bag to a prosperous looking man, who said rudely: "I have nothing."

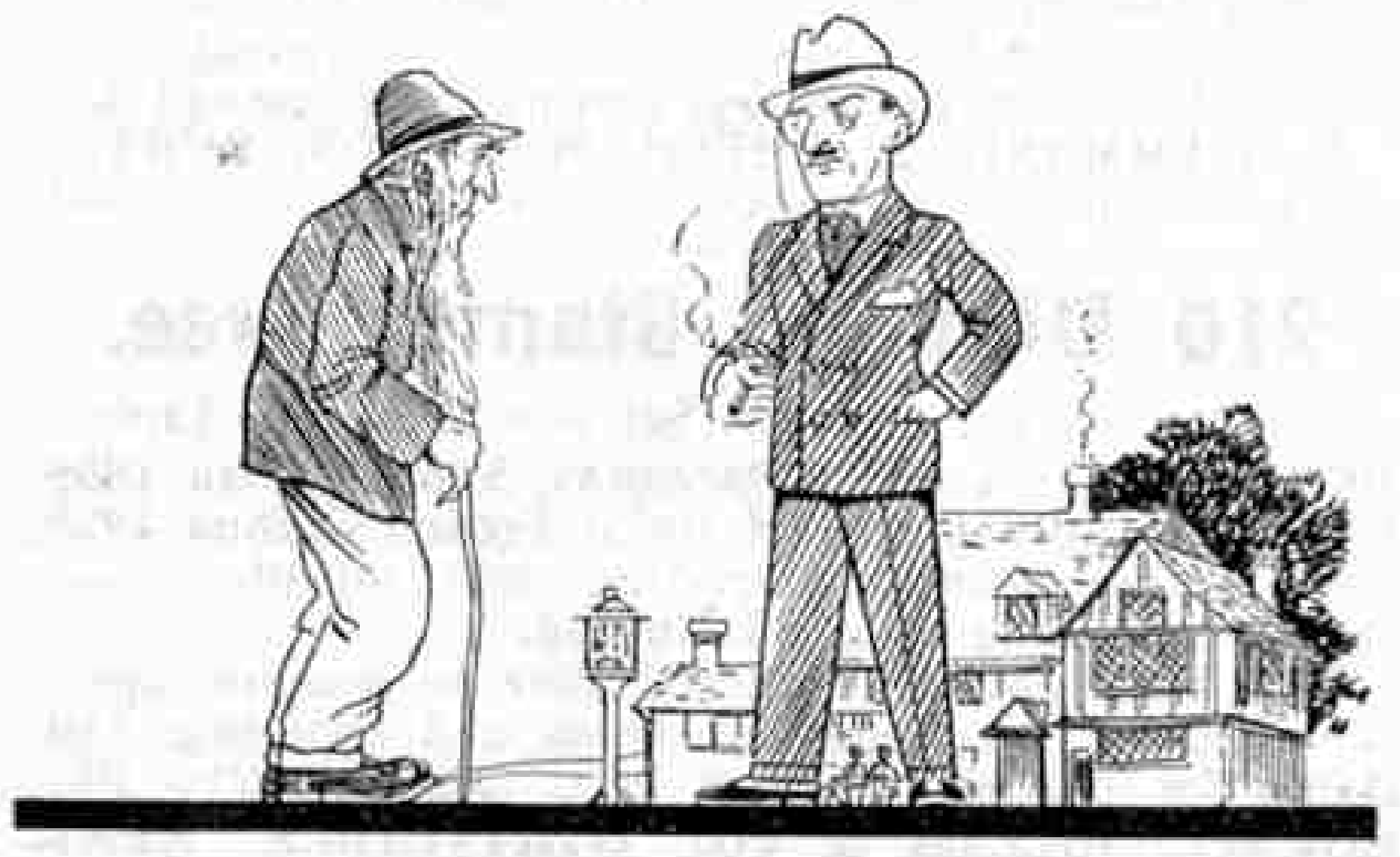
"Then take something, sir," replied the lady. "I am collecting for the poor."

* * * *

Reggie: "It isn't fair. At night I am too little to stay up, and in the morning I am too big to stay in bed."

* * * *

NO MORE



The man from the big town had been decidedly patronising in conversation with the oldest inhabitant of the village.

"And what is the death rate here?" he tactlessly asked.

"Same as everywhere else," replied the old man. "One death for every inhabitant."

* * * *

Teacher: "Smith, give me a definition of 'steam.'"

Smith: "Please, sir, water gone crazy with the heat!"

Tommy (who had dropped a bag of eggs and fallen on them): "Are they broken?"

Father (reaching for the cane): "Oh, no! A bit bent, perhaps."

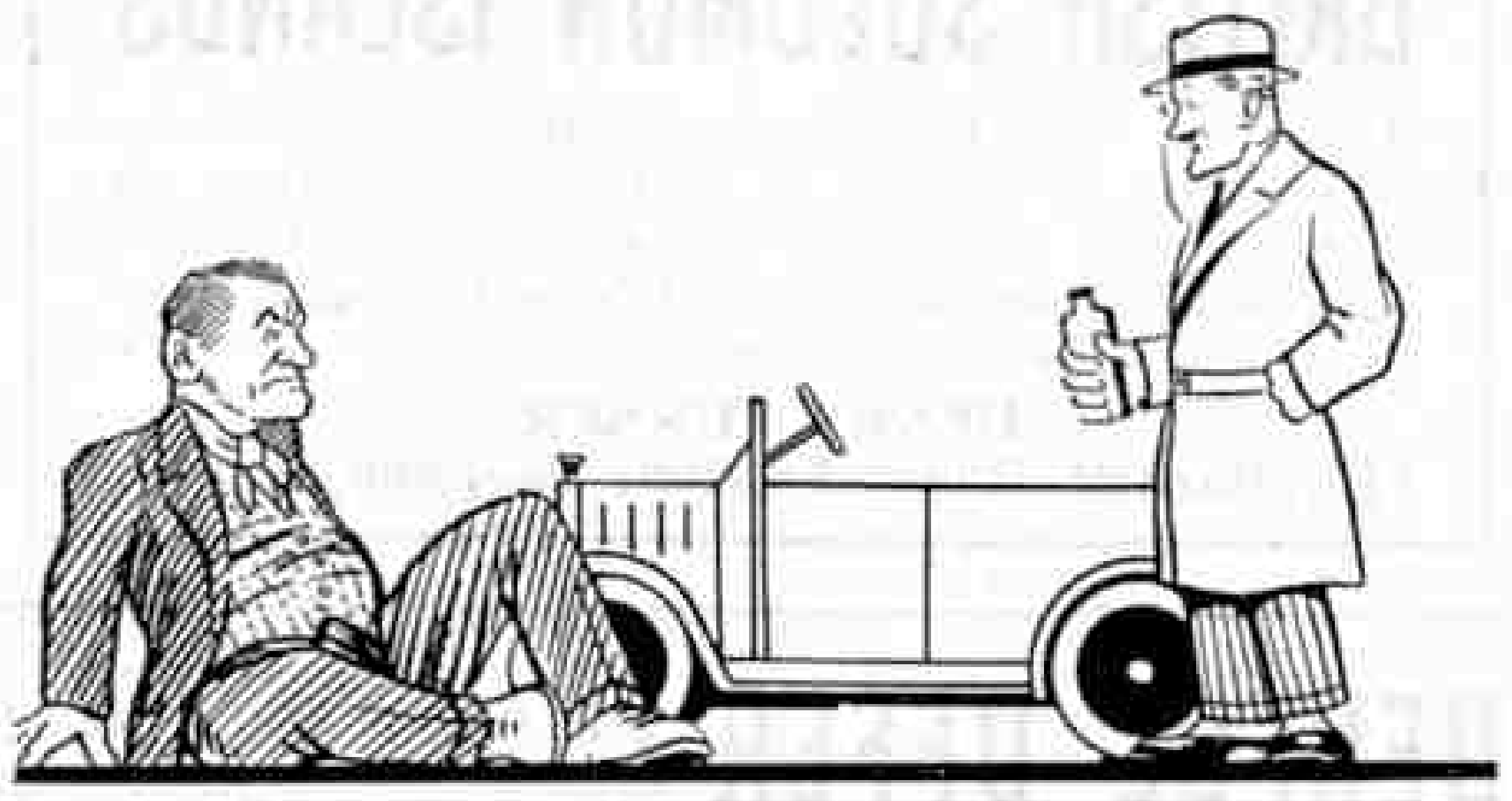
* * * *

Client (to lawyer who has got him acquitted on a charge of housebreaking): "I'm sure I'm very much indebted to you, sir. I'll never forget it. I'll look you up again some time."

Lawyer: "Oh, do. But I should prefer a daytime call."

* * * *

SCARCELY CREDIBLE



Bill the Prizefighter got in the way of an Austin Seven. His two hundred pounds caught the full impact, and he was knocked unconscious. When he came to, he looked for the cause of the trouble.

"Wot did that?" he asked.

"My car," said the owner.

"Your wot?" said Bill, "Lumme! Fancy me being knocked out with a roller skate!"

* * * *

Sergeant (reporting fatal accident to inspector): "There was an escape of gas in the boiler room, so I sent Murphy down to locate it, sir, and he struck a match and —"

Inspector: "What! Struck a match! I should have thought that would have been the last thing on earth he would have done."

Sergeant (drily): "It was, sir!"

* * * *

Editor: "Look here, Jones, would you like to take a day off?"

Office Boy: "Thank you very much, sir. Very much obliged, sir."

Editor: "Well take it off that calendar, it's the 14th to-day!"

* * * *

Child (to stranger in a railway carriage): "Daddy, Daddy!"

Mother: "Hush, George. That isn't daddy; it's a gentleman."

* * * *

Visitor: "How many work in your office, Mr. Smith?"

Mr. Smith: "About one in every ten."

* * * *

Solicitor: "I will certainly take up your case. I feel sure I can get justice for you."

Client: "Well, if you can't do better than that I must get another solicitor."

* * * *

Barber: "Well, my little man, and how would you like to have your hair cut?"

Little Freddy (aged six): "If you please, sir, just like father's, and don't forget the little round hole at the top where the head comes through."

* * * *

BUSINESS

As soon as the traveller entered the office the manager said hurriedly: "I am sorry, but I cannot see you to-day."

"Well," replied the traveller, "it's lucky I called. I represent a firm of spectacle makers!"

CONSCIENCE MONEY

An elderly man travelling on the last tramcar with his grandson, was seen to be looking at his watch with an eager expression on his face. Suddenly he put it away and exclaimed "Ah!" and, beckoning to the conductor, said: "I want to pay the rest of my grandson's fare. He has just become twelve years old."

* * * *

Smith: "Is your typist a fast worker?"

Jones: "She's so fast that she has to use a water-cooled typewriter with an asbestos ribbon."

* * * *

Mr. Newrich was showing an acquaintance round his palatial new abode. The walls were covered with paintings in their gilded frames.

"This," said Mr. Newrich, stopping before a portrait of a knight-of-old in armour, "is one of my ancestors."

"Yes, and he was very nearly one of mine," replied the visitor. "I bid up to £2,000 for that portrait, but didn't think it was worth any more."

* * * *

Amateur Gardener: "Ethel!"

His Wife: "Yes, dear?"

A.G.: "About this acorn. Where do you think it will give most shade?"

* * * *

"Smith, did you notice that pile of wood in the yard?"

"Yes, sir. I seen it."

"You should mind your grammar. You mean you saw it."

"No, sir. You saw me see it, but you ain't see me saw it."

* * * *

Shopper: "Here young man, there's a ladder in these stockings!"

Exasperated Assistant: "Well, what do you expect for 2s. 11d., madam—a marble staircase?"

* * * *

First Dentist: "What do you think of my new waiting-room? The fire-escape makes it one of the safest rooms in the building."

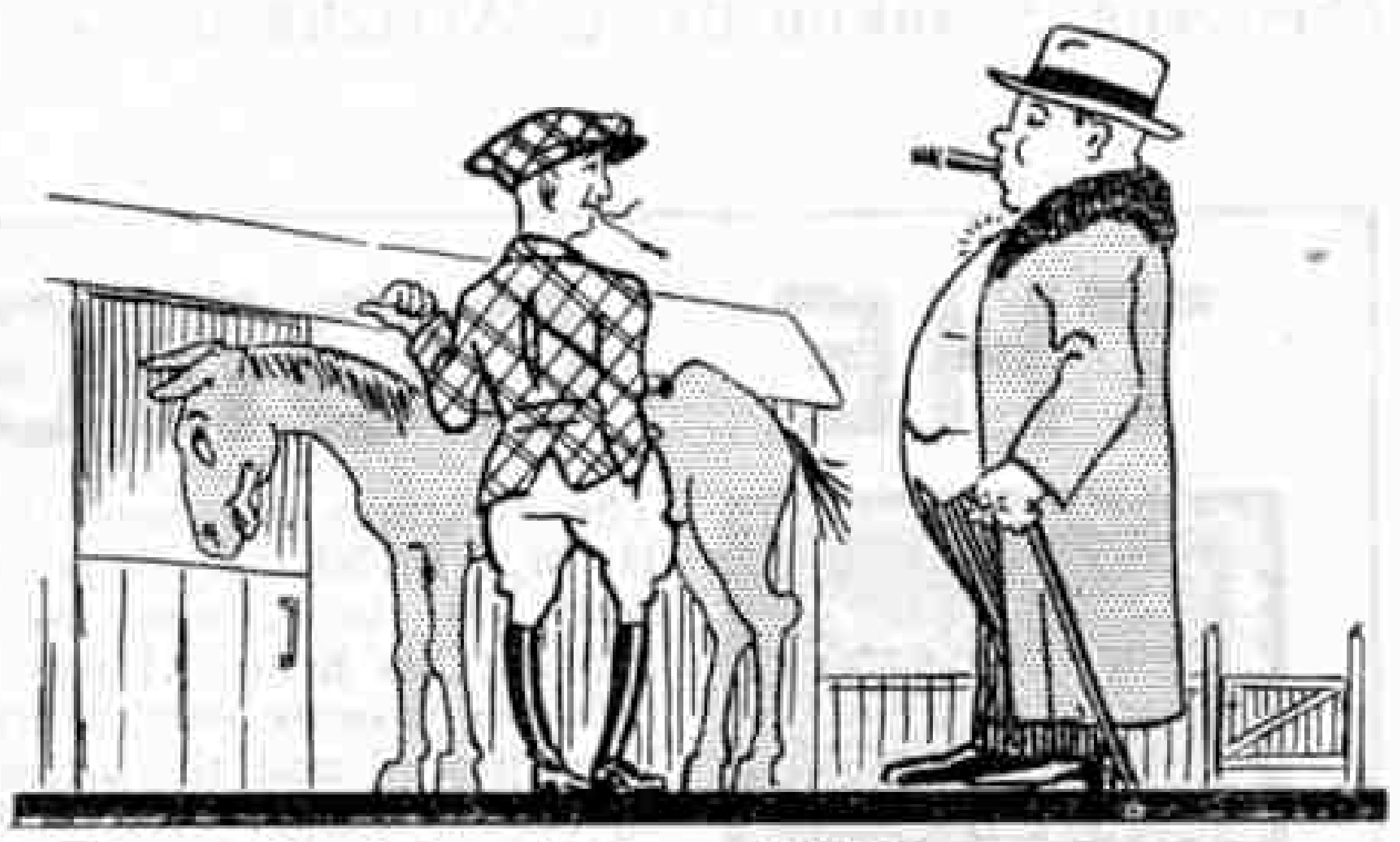
Second Dentist: "Safe? Why, I lost twelve patients that way!"

* * * *

Approaching a lonely cottage, the tramp knocked at the door. "Have you any dinner for a hungry man?" he asked of the good lady. "I have," was her reply. "And he'll be home to eat it in five minutes."

* * * *

NO NECESSITY



Prospective Horse Buyer: "Well, my man, are you sure this horse has plenty of initiative?"

Stable Hand: "Yes, sir. Why, yo' don' even have to tell 'im to stop."

* * * *

Mr. Brown: "I'm sorry I bothered you on such a terrible night, doctor."

Doctor: "That's all right, I had another patient just down the road and I thought I'd kill two birds with one stone."

THE BEST

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"DIAMONDS"

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50 Bulgaria and Thrace, some mint ...	1/-
100 Ditto.	2/9
100 French Colonies, many mint ...	1/-
100 Hungary, mint and used	9d.
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The " 1,000 Packet " contains **500** excellently assorted Stamps, a COMPLETE SHEET of **100** UNUSED (very useful for exchange purposes) ; a neat **12**-page booklet for holding duplicates ; **25** British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues ; **375** Magic " Strip " Mounts, and my price list of stamp bargains. Price **4½d.,** postage **2½d.** extra, abroad 6d. extra. In addition, free sets will be sent to those who send name of stamp collecting friends. *Ask for my famous approvals.*

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SETS (POSTAGE EXTRA)

10 Australia ...	3d.	20 French Cols. ...	2d.
15 ,, ...	8d.	30 ,, ,, ...	4d.
18 ,, ...	1/-	40 ,, ,, ...	7d.
10 Canada	2d.	50 ,, ,, ...	10d.
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25 ,, ...	9d.	20 Roumania ...	2d.
30 ,, ...	1/-	25 ,, ...	3d.
35 ,, ...	1/6	30 ,, ...	4d.
20 France	2d.	35 ,, ...	5d.
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40 ,, ...	5d.	45 ,, ...	7d.
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5 Bolivia	3d.	55 ,, ...	10d.
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SIX FINE BRITISH COLONIALS

Stamps exclusively from our tropical island possessions. **Borneo,** 1897, 3c. **Palm** ; Fiji, K.G., 2d. ; Mauritius (Arms), 4c., black and rose ; **Papua**—New Guinea, 2d. **(Pictorial)** ; **Samoa (Palms)** ; Zanzibar (Sultan). Sent to applicants for Approvals enclosing 6d. and 1½d. postage. Price without Approvals 1/6 post free.

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A grand packet of **25 Different Stamps,** containing **Sardinia,** unused ; **Andorra,** the latest stamp-issuing country ; **Transvaal, 1896, 1d.,** unused, a fine stamp ; **Morocco Agencies,** K.G., unused ; **N. Borneo,** pictorial ; **Guadeloupe,** 1928, new issue ; **New Caledonia,** 1928, new issue ; **Kouang-Tcheou,** unused ; **Travancore,** unused ; **Cape of Good Hope ; Martinique,** creole ; **St. Pierre and Miquelon ;** New Zealand, Admiral ; **French Morocco,** pictorial ; **Dahomey,** pictorial, etc., etc., free to all asking to see my famous approval sheets and enclosing **2d. for postage and packing (abroad 3d.).**

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THE CONGO PACKET

The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only*, representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS Stamps. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of **10 CONGO** (including the Stanley Stamps) usually sold at **1/-**. Senders of addresses of stamp collecting friends will receive a free set in addition.

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The 210 Packet contains **Set** new **Belgium (Lion).** 1929 unused, scarce **7c. Paraguay, Syria, British 1858, Eitrea,** set unused new pictorial **French Guiana 1929,** also further scarce, interesting, and out-of-the-way stamps including over **80 Unused.**

This **Fine** packet is offered **Free** to genuine applicants asking for approval sheets and enclosing **1½d. stamp** for postage (Abroad 6d.). Mention 210 Pkt.

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R. WILKINSON, Provincial Buildings,
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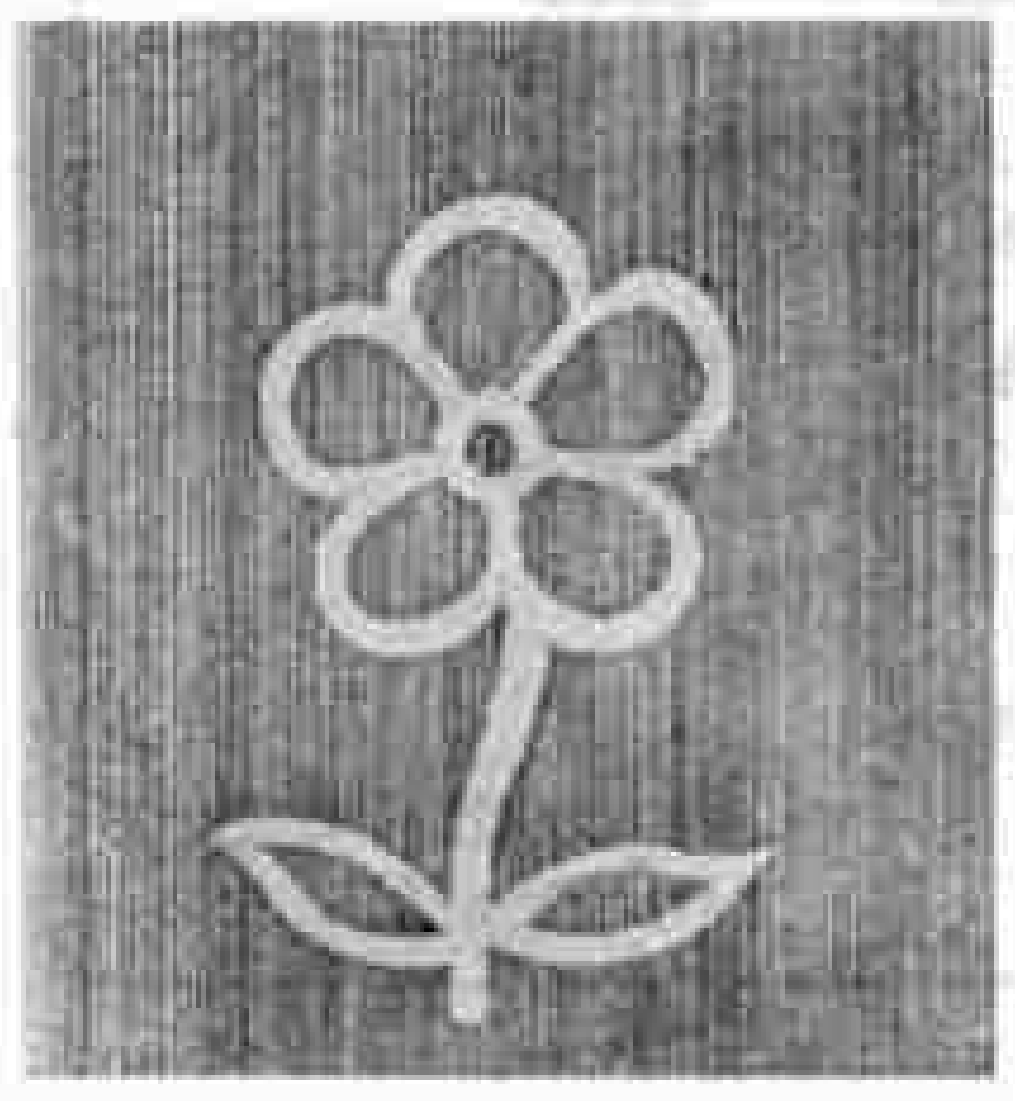
STAMP COLLECTING

POSTAGE STAMPS IN THE MAKING

FOR several months past we have been observing the pageant of stamps and examining their story from much the same angle as an audience watching a play. This month let us peep behind the scenes and see how these tiny actors are "made up" for the parts they are to play.

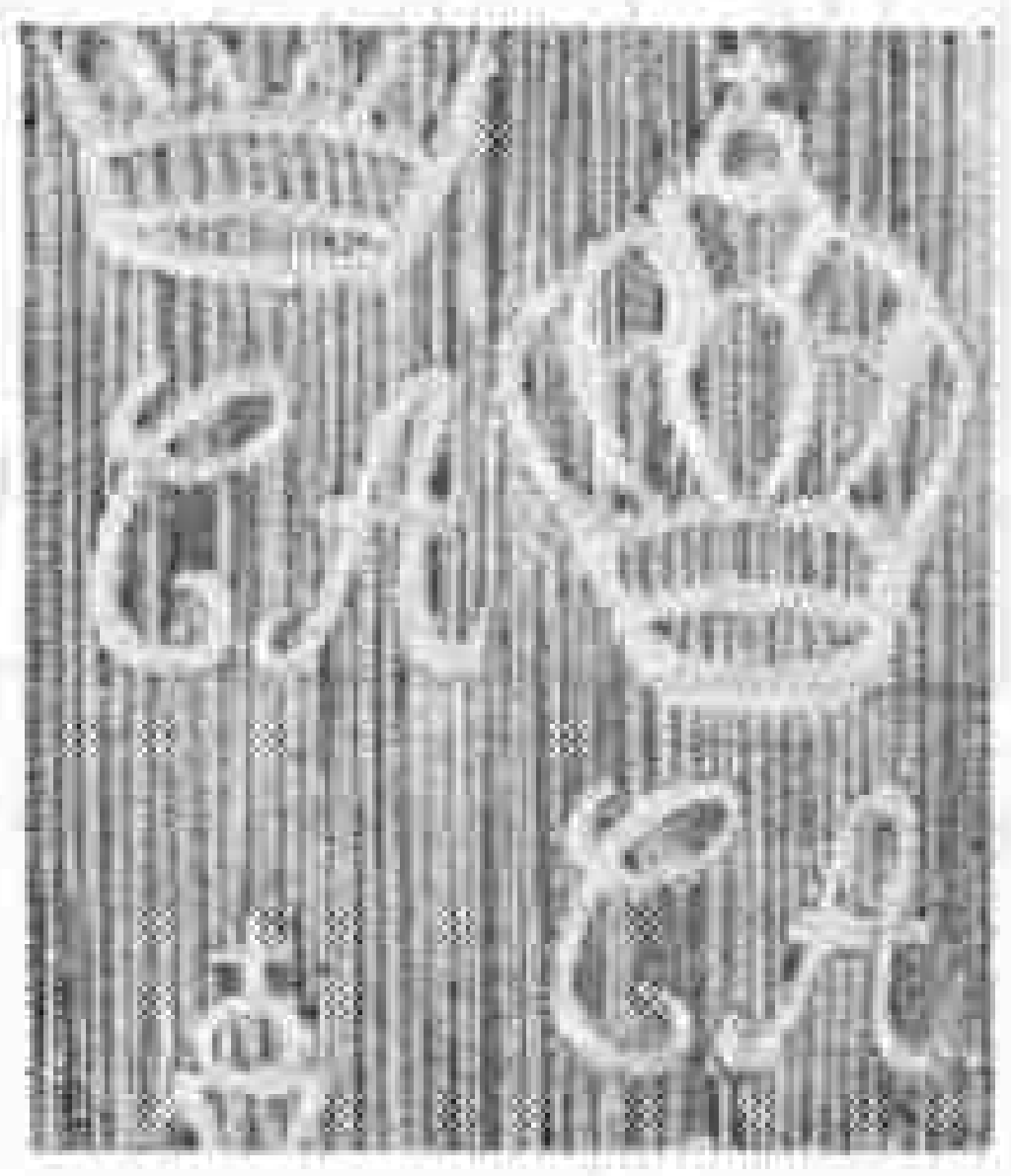


The collector who intends to make his hobby an all-absorbing pursuit must make a study of the technical processes of stamp production, for it is out of these that the major and minor varieties arise. The general collector, too, finds an acquaintance with these things exceedingly helpful, for he may be entertaining unawares in his collection some rare gem that varies only slightly from commoner specimens of the same issue. In this, and a dozen other directions, knowledge of the various papers employed, watermarks, printing processes and perforations may be of extreme value.

The commonest varieties of paper that are encountered are known technically as *wove* and *laid*. A wove paper may be distinguished by the evenness of its texture, like that employed in the printing of the "*M.M.*" It is without any special distinguishing feature, and it is used for a very large proportion of modern stamp issues. Laid paper can be identified by parallel watermark lines running vertically or horizontally across the paper. Another stamp paper is known as *granite*, and derives its name from minute flecks of coloured fibre in the paper. These are easily visible to the naked eye. The 5c., 10c. and 20c. Swiss, 1928, Pro Juventutes are on granite paper, but plain was used for the 30c. value. A fourth type of paper is known as *pelure*, a thin semi-transparent paper of considerable strength. The term nowadays is very loosely applied to any kind of thin paper, irrespective of its toughness. A more uncommon variety of paper is known as *quadrille*. Its distinguishing feature is a network of watermark lines running vertically and horizontally to form a pattern of squares or rectangles.

Rarely to-day does a modern issue appear on paper unprotected from forgery by some watermark device in the texture. At one time it was more or less customary to prepare the paper so that a single watermark appeared in each stamp. The Great Britain "Spray" watermark, used in the 1870's, illustrated here, is a case in point. This method necessitated exceedingly careful registration of the printing plates and the paper, and to avoid this additional trouble multiple watermarks are employed. These are small designs such as the *multiple script C.A.* in the current British Colonial issues, which also is illustrated; and they are worked into the whole of the sheet of paper so that each device appears partially or completely several times on each stamp.

Most watermarks are easily visible by holding the stamps up to the light, but if the mark cannot be seen in this manner it will show up when the stamp is placed face downwards on the black surface of a watermark detector and saturated with a drop or two of benzine. In examining watermarks it is important to remember that the mark reads from left to right, just as the stamp design. Therefore, when the mark is examined from the back of the stamp it is seen in reverse form.



The surface of the paper is usually specially prepared to present a good printing surface and, more important still, to prevent the removal of postmarks from used stamps. Thus we get chalk, enamelled and tinted surfaces. The two first-named are similar in appearance, but the difference between them can be detected by rubbing their surfaces with the edge of a silver coin. On a chalky specimen a fine pencil-like line is produced, but the enamelled paper will not respond.

Tinted surface stamps, known as "white-backs," appear quite frequently in British Colonial issues. Two that come to mind are the current Sierra Leone 1/- value, printed black on a green surface with a white back; and the New Zealand Dunedin Exhibition issues of 1927, which were respectively yellow-green on green, carmine on rose and mauve on pale mauve. The Dunedin Exhibition stamps were also treated very heavily with chalk.

It is in the printing of stamps that the majority of varieties arise. These varieties are known as *shades*, and are due to slight differences in the action of the printing ink. Although successive printings may vary very little indeed from their immediate predecessors, it is not infrequent that quite important variations appear as between one stamp and another of nominally the same type and colour, issued with long intervals between them. For example, the stamps of the Great Britain King George issues show some very slight variations.

Such minor variations, of course, are entirely different from intentional alterations, such as were witnessed some years ago when all the British 1d. Colonial stamps were changed from carmine to scarlet, and the $\frac{1}{2}$d. Great Britain from blue-green to yellow-green. These changes must be noted by every collector, but unintentional minor varieties may be disregarded by all save the specialist. Often enough catalogues differ as to the actual colour of a stamp, the confusion arising chiefly from the fact that there is no recognised system of naming the colours. We recommend every collector to use a colour guide, such as that issued by Stanley Gibbons Ltd., as a check when identifying stamps.

There are three distinctive methods of printing, line engraving, surface printing or typography, and lithography. The finest work is the first-named, and many of the most beautiful stamps that have been issued are specimens of the engraver's art. Before dealing with the difference between the three processes, it will be well to explain that in every case a flat plate is employed.

(*Continued on page 341*)

FREE. 110 different Stamps to genuine approval applicants.—Gosling, 163, Felixstowe Road, Ipswich.

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 135, Cambridge Road, Seven Kings.

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3 DIFF. TRIANGULARS FREE
To Approval Applicants stating type of Stamp required.
DEPT. 4, TAMARISK, HERNE BAY.

AUSTRALIA:
1½d. Canberra; or **3d.** King George; or **1d.** 1913 engraved (mint) sent free to applicants for approvals from
R. D. HARRISON
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BRITISH COLONIALS ONLY

Have you seen them ? Record approvals of Foreign & Colonial Stamps. Huge discount of **8d.** in 1/– or for all net purchases of 2/6 and upwards, **9d.** in 1/– dis. These selections are sent out in approval books and contain superior stamps, far better than the trash that is often sent out on approval sheets and only **6d.** in 1/– discount allowed. This is why No **Free Gift** (often of no value) is given. The **full value** is in the approvals.
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Stamps of **Salvador** printed diamond shape. These curious stamps improve a collection. ... The Set **1/–**
Nicaragua, 1892 or 1893, each set only **1/–**
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Argentina 1862-64 5c., 10c., 15c., catalogue £25, if you cannot afford these have the reprints for **6d.**
First class Approval Selections. Reasonable Prices willingly sent with any orders.
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LONG SETS AT SHORT PRICES
All Different. Postage Extra.

50 Algeria	1/9	50 Dutch Indies	2/–
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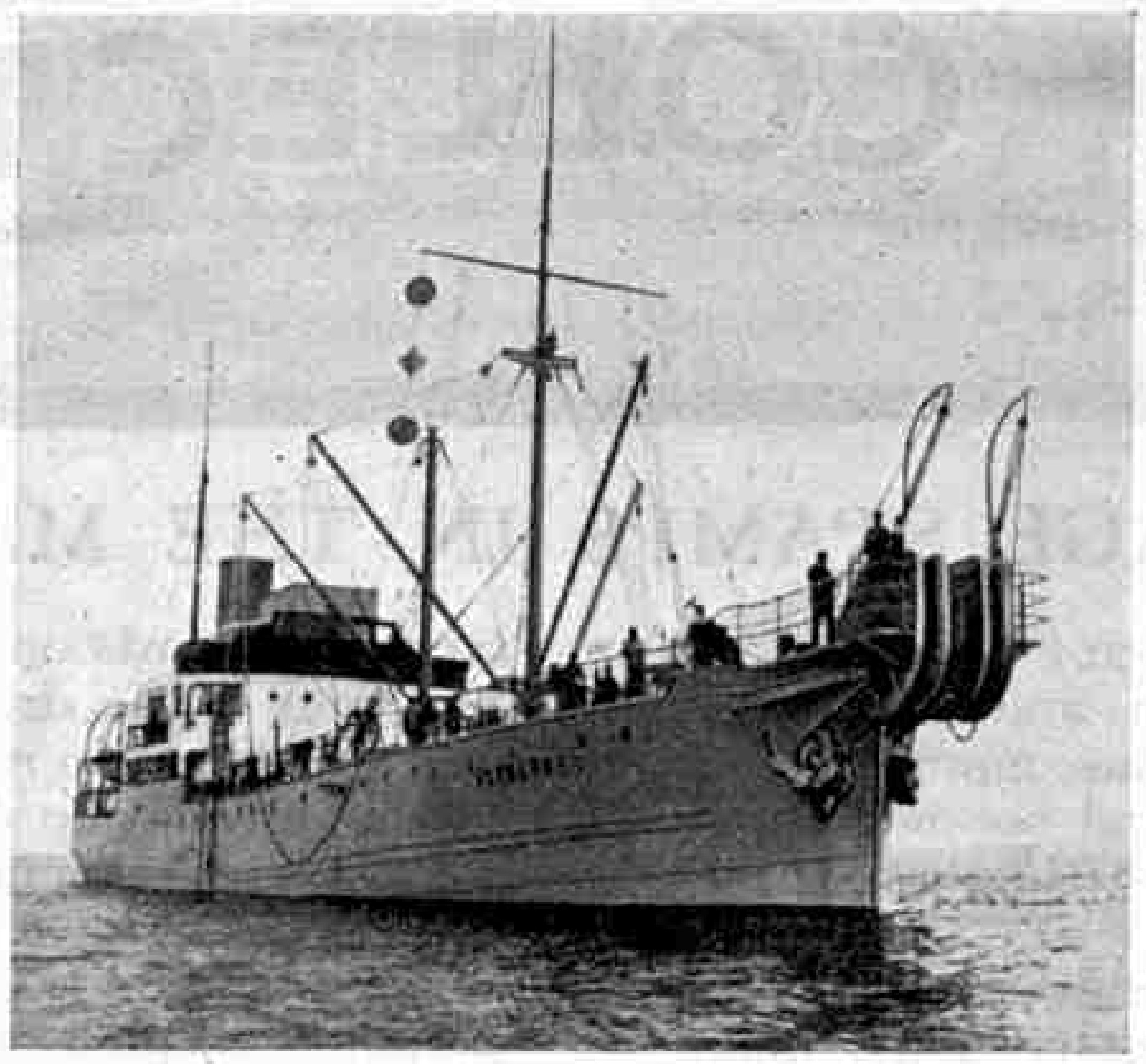
50 Denmark	10d.	50 Luxemburg	1/6

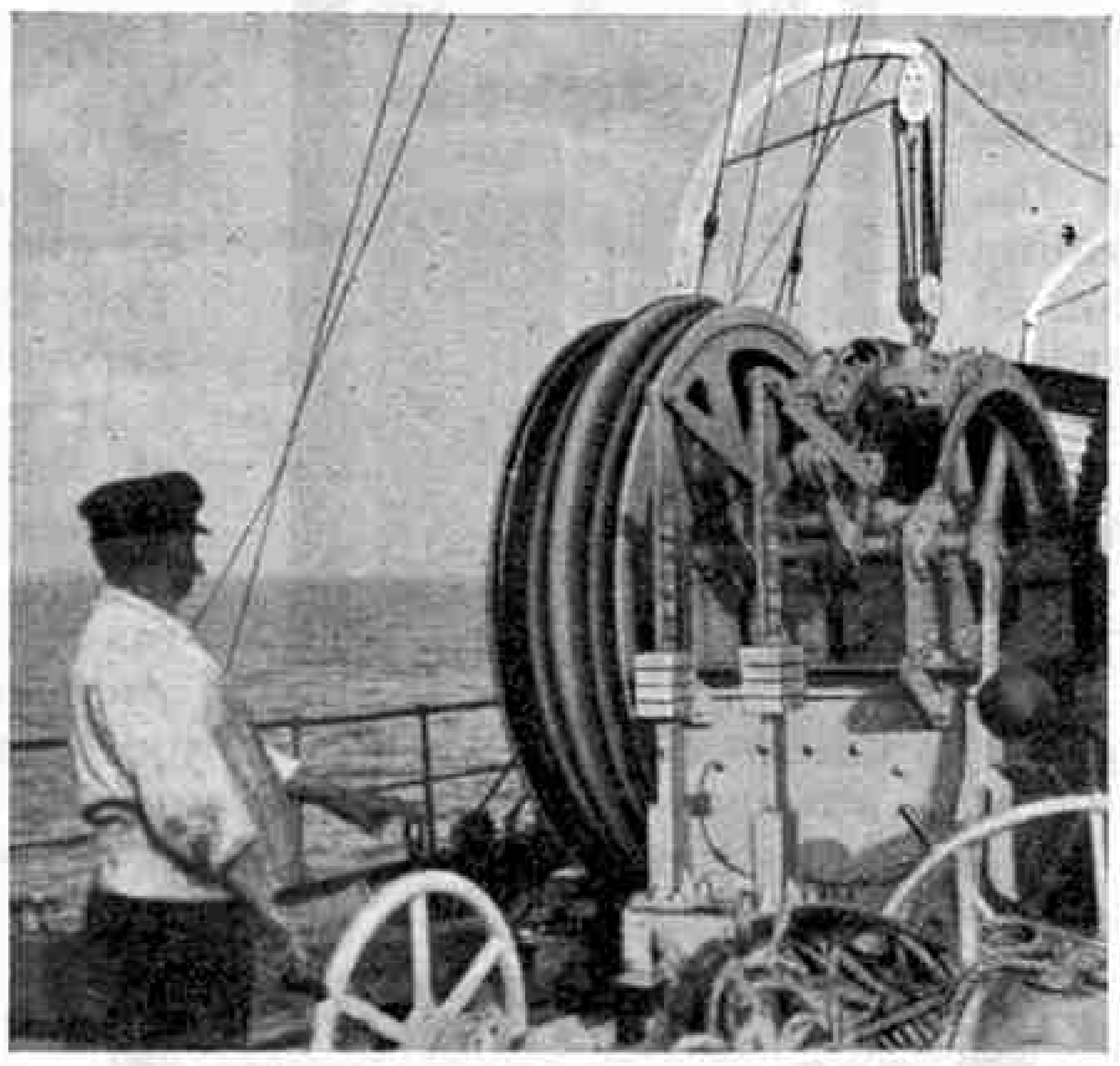
R. GODLEY
(Dept. M.), 8, Highbury Hill, London, N.5

Laying a Telephone Cable—(*cont. from page 313*)

She examined and lit up the marking buoys, and on the night of 29th August began the actual laying of the cable from the point where the end of the larger cable had been sunk. This time the making of the splice connecting the latter with the main cable was postponed until the completion of the laying. All this time it was necessary for the vessel to keep strictly to the course marked by the buoys in order to make sure that the length of the cable on board would be sufficient. At an average speed of four knots one coil after another of the cable in the tank was run off, passed through the guide roll on the deck, twisted two turns round a brake-drum and then slid over the huge stern sheave down to the bottom of the sea. While the laying was in progress the electrical condition of the cable was tested continuously.



The cable-layer "*Norderney*"



The paying out machine and brake drum

The whole operation of laying the main cable lasted 16 hours, the "*Norderney*" arriving in the Bay at Kämpinge at noon on 30th August. Owing to the shallowness of the water she had to remain some 1,650 yards from the Swedish coast, and a flat-bottomed lighter towed by a motor boat completed the laying to the shore. The actual landing of the cable was carried out by boats. The end was drawn into the Kämpinge cable house and a portion of the shore end of the cable was dug into the sand.

As soon as the landing was completed the "*Norderney*" again put to sea in order to release the cable buoys from their anchors and haul them aboard.

(*Continued at foot of previous column*)

(*Continued from column 2*)

The only task then remaining was that of joining the two portions of the cable, and this was accomplished successfully on the night of 1st September after each portion had been thoroughly tested for electrical continuity.

The new cable has an overall diameter of 2.21 in. and contains 48 conducting wires bound up in 12 sets of four. As it will be used for four-wire operation, 12 calls may be made simultaneously with its aid. It is intended chiefly for long-distance communication and will connect Norway and Sweden with the network of long-distance cables that at present covers England, Holland, Belgium, Germany, France, Switzerland and Austria. It possesses the distinction of being the biggest and longest loaded submarine telephone cable yet laid in which paper insulation and lead sheathing are used.

"THE MONARCH" Regd. **De-Luxe Large CAMERA**
Fitted with Genuine **Guaranteed Meniscus Lens, Reflex Viewfinder,** Nickel-plated **Spring Lever Shutter, Lever Guard, Real Leather Handle,** and absolutely **GUARANTEED to TAKE PERFECT LARGE PHOTOS.** **Size 3½ x 2½″**
SALE PRICE 1/9 ONLY! Post3d.
BRITISH MADE and supplied complete with all accessories! Send **P.O. 2/- for complete Outfit ! Testimonials Galore !** W. J. Thomas, Esq., writes : "Developed and printed photo; think it as good as if taken with a Camera which cost £3."
"MONARCH" *Regd.* **FILM CAMERA,** Fitted Meniscus Lens! Time and Snapshot! Takes Vest Pocket size film! Perfect Photos guaranteed! A real beauty! **Sale price 3/6** (Postage, etc., 6d.). *Sale Catalogue* 1,000 *Big Bargains Post Free.*
THE LEEDS BARGAIN CO. (M), **31, Kendal Lane, LEEDS.**

MODEL RAILWAY CLUB
EXHIBITION
OF MEMBERS' WORK
KINGSWAY HALL
KINGSWAY, W.C.1 1929
WEDNESDAY, APRIL 17th
2 p.m. to 10 p.m.
THURSDAY, FRIDAY, SATURDAY
APRIL 18th, 19th, 20th
11 a.m. to 10 p.m.
ADMISSION :
Adults 1/2 (Including Tax)
Children 6d. (under 12)

Famous Trains—(*continued from page 283*)

in length. You can well understand that boring so long a tunnel at this tremendous altitude was no easy task. The temperatures were very low, and some of the worst difficulties arose from the tapping, at three different points, of powerful springs of very cold water, which between them held up the work for 15 months. For over a mile the rock pierced is so hard that it has not been necessary to line the tunnel here with masonry.

It takes us about ten minutes, or slightly less, to pass smoothly through, and on emergence we find we have come out into another world. We have passed from the watershed of the Rhine into that of the Danube. The luxurious vegetation and dense forests of Western Switzerland give place to a comparative barrenness. In the crystal-clear air the great giants of the Roseg group of Alps, over 13,000 ft. in height, stand out prominently across the wide valley of the Inn. We stop first at the junction of Bevers, exactly at midday; here is detached a through coach that is going down the Lower Engadine to Schuls-Tarasp. Four minutes later we are at Samaden, where the portion for Pontresina—3¼ miles away, up the valley to the left—parts company with us. A brief stop at Celerina, and at last, at 20 minutes past twelve, in excellent time for lunch at our hotel, we are at rest in the fine station at St. Moritz, alongside the lake, and in the heart of the noblest scenery in the Grisons.

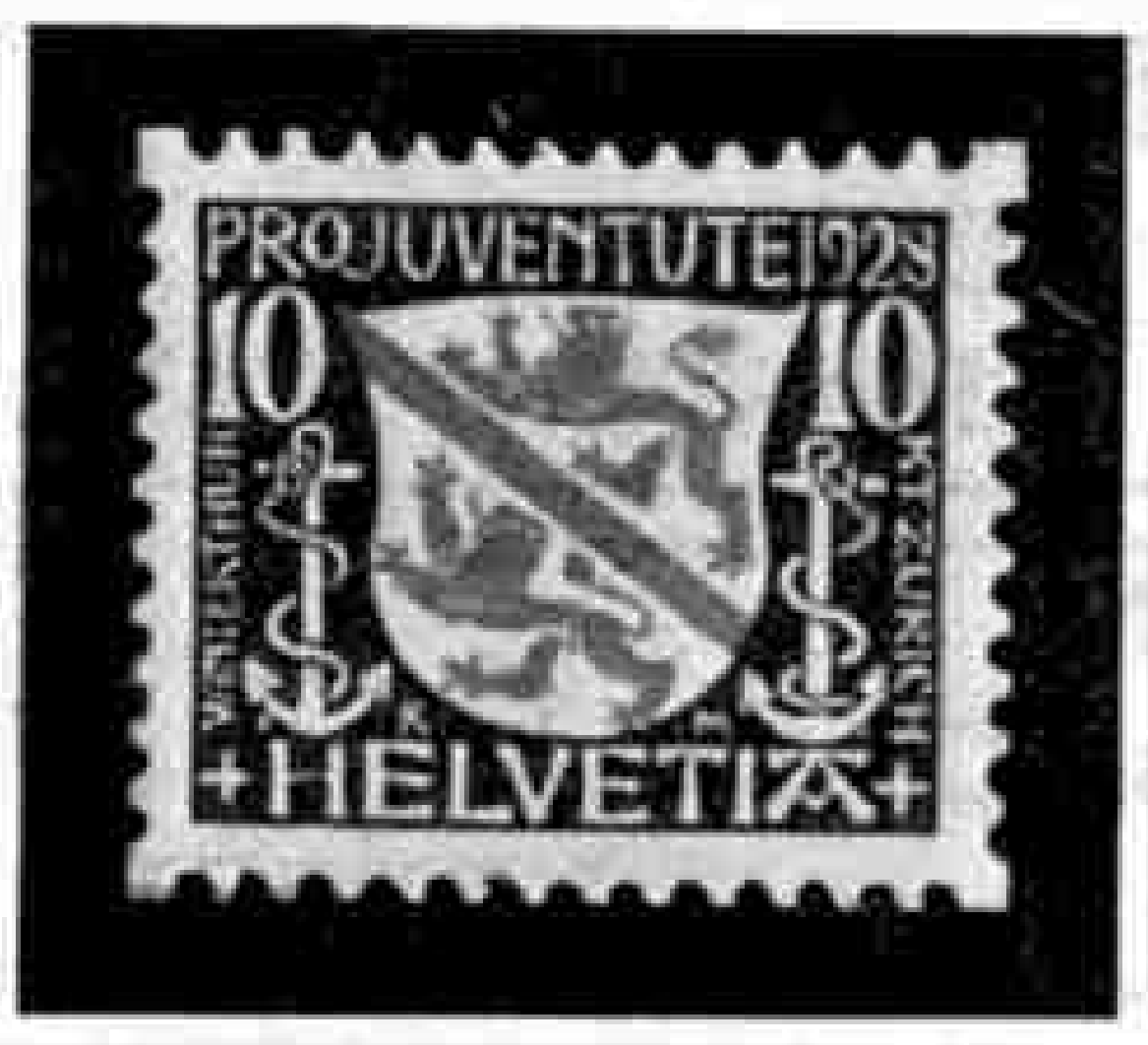
Well, I have brought you to the Engadine by the "*Engadine Express*"; and if this wonderful valley appeals to you as much as it does to me, it is going to be a mighty difficult business to get you home again!

NEXT MONTH
THE TWO-HOUR BRISTOLS
(Great Western Railway)

Stamp Collecting—*(continued from page 339)*

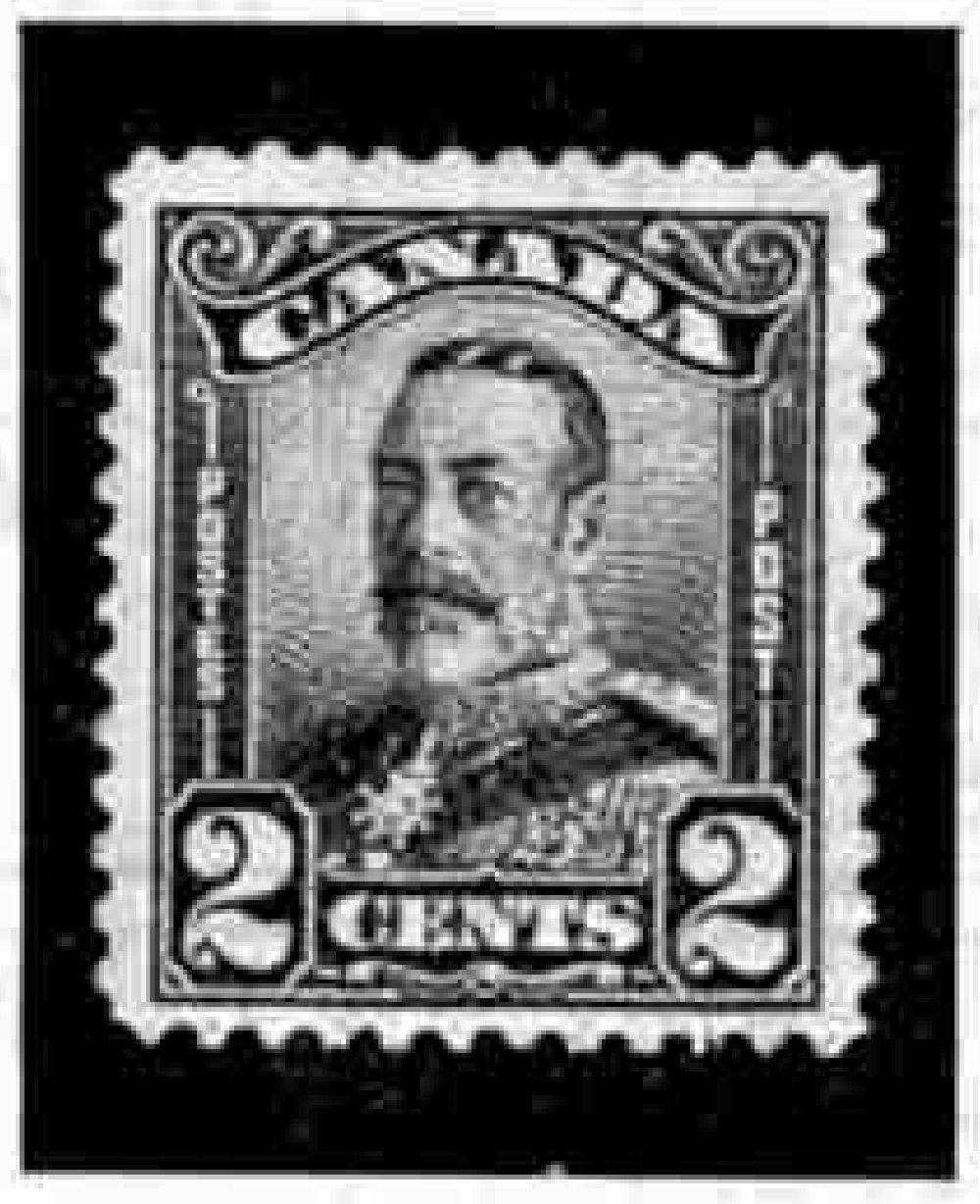
In line engraving, the design is cut into the flat surface so that the printing ink is held in the lines, and to secure an impression the paper that is being printed must be brought so firmly into contact with the printing surface that actually it is forced into the cuts formed by the lines. Thus one finds that the fine lines of the design actually stand up in minute ridges. The Turkish "Adrianople" issue of 1913, from which we illustrate the 2 paras value, was line engraved.

In surface printing, the whole of the surface of the printing plate, with the exception of the lines of the design, is cut away, and the ink applied to the upstanding portions. This is the ordinary printing process by which books and magazines are produced to-day. A specimen of the current United States issues, produced by this method, is shown here.



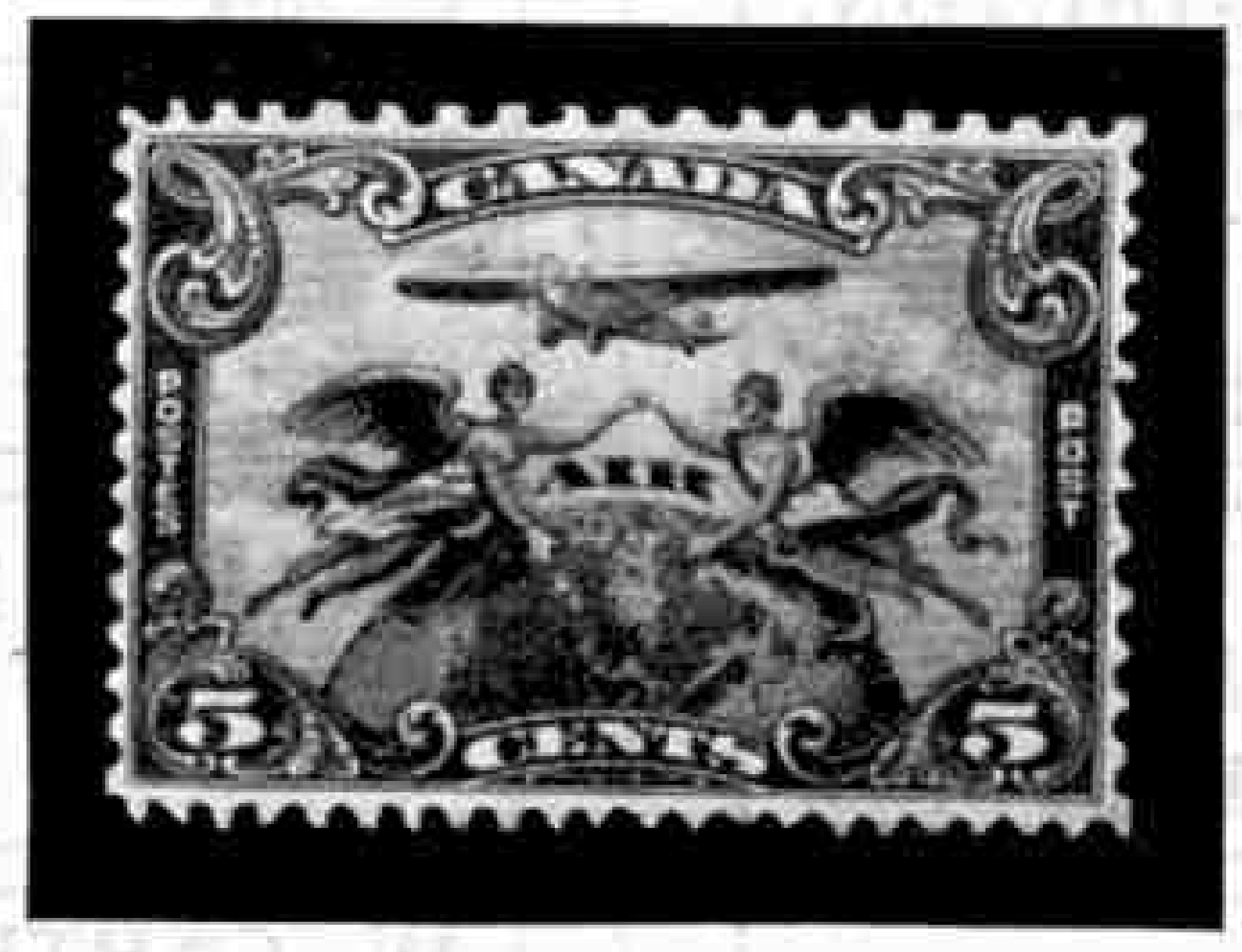
The third process, lithography, is much more complicated. There are neither ridges nor depressions on the plate, and as a result the appearance of a stamp produced by lithographic methods is apt to be dull and flat. In this process the actual design is transferred on to what is known as a *lithographic stone,* the lines being drawn in on this surface with a substance that will absorb printer's ink. The rest of the surface is treated with a substance that rejects the ink, which thus adheres only to the lines of the design. The Greek stamps of the 1912/20 issue were lithographed. We illustrate the 3 lepta value.

Some very beautiful results have been secured with a new process known as collogravure, used for the first time in the production of the Egyptian stamps that bear the portrait of King Fuad. It is an improved form of photo-gravure, having neither screen nor grain, and was used because King Fuad, a very keen collector of stamps, desired to give his people a really true likeness of himself and not a caricature. It is, unfortunately, very true that stamp portraits often resemble anyone but the person intended. A recent instance of poor reproduction occurred in the higher values of the current New Zealand issues, showing King George in admiral's uniform, which raised an amazing storm of criticism.



In the early days of stamps, the sheets were issued to Post Offices without provision being made for separating one stamp from another, and cutting with scissors was the only method of separation. As the demand increased, so the unsatisfactory nature of this arrangement became increasingly apparent, and the perforating machine came into being. There are three principal types in use. The "comb" machine has its perforating pins so arranged that they perforate one long line and a number of short ones at right angles in one blow. Sheets perforated by a comb machine can be distinguished by the fact that the margin at the bottom of each sheet is perforated at right angles to its edge. "Single line" machines perforate one line at a time, and when all the lines across the sheet have been completed, the sheet is turned and the side perforations are made. The third machine is known as the "harrow." This perforates the whole of the sheet of stamps in one blow, the pins being laid out in rectangles so that they have the appearance of the agricultural harrow.

Perforations are of importance, in that a variation in the number of perforations to each stamp often indicates the introduction of a new machine, and therefore assists in putting an approximate date on the appearance of any particular stamp of a design that has been employed for a long time. The standard of perforations is the number of holes that appears in a space of two centimetres. Thus the description Perf. 12½ means that the stamp is perforated all round with 12½ perforations to every two centimetres. If the spacing at the top and sides varies, it is customary to indicate the top figure first; thus 12½ × 13 means that the perforation along the top is 12½ and down the sides 13.



Any stamp dealer can supply a perforation gauge marked with rows of black dots that fit exactly into the perforated holes. To find the perforation number of a stamp, move its edge up and down these rows until the dots in one of the rows fit the side of the stamp. The figure on the gauge alongside that row gives the perforation number.

Another system of separating stamps is rouletting, which differs from perforating in that no paper is actually cut away from the sheet. What is known as a normal roulette consists of a series of short straight cuts made by a toothed wheel. There are also zigzag, serpentine and saw roulettes, each of these terms being descriptive of the actual arrangement of the cuts.

The object of the elaborate precautions of which we have given a brief outline is to defeat the would-be forger. A further precaution in this direction is the use of what are known as "fugitive" inks. These inks are affected very badly by moisture, which robs of their brilliance the aniline colours that are used. On this account it is very important, when floating stamps of this type off their backing paper, not to allow the moisture to penetrate through to the front of the stamp. The backing paper should be soaked only to a sufficient extent to wet the gum, and then, provided due care is taken, the stamp may be pulled away quite easily and without damage.

Stamp Gossip

New Canadian Issues

We illustrate on this page specimens of two recent Canadian issues. The first is from the new general issue and shows a portrait of His Majesty the King which appears on the 1, 2, 3, 5, and 8 cent values. The remaining five values are devoted to Canadian scenery. On the 10 cent the British Columbian mountains appear, Quebec Bridge on the 12 cent, a prairie wheatfield on the 20 cent, a seascape on the 50 cent, and the Parliament Building at Ottawa on the dollar value.

The new series has amazing beauty of design, fineness of engraving and delicacy of colouring, surpassing even Newfoundland's current issue, and is a credit to the Canadian Postal Authorities.

The second illustration shows a five cent air mail stamp. This is curiously reminiscent of the Confederation Diamond Jubilee issue of July, 1927, and its design is in every way worthy of that very fine commemorative effort.

A point of particular interest in both issues is the retention of the English and French versions of the word "*post,*" which may be regarded as a tribute to the considerable French population in the Dominion.

* * * *

U.S. Commemoratives

The United States Postal Department have made a curious departure in commemorative stamps by employing overprinted general issues to celebrate the 150th anniversary of the discovery of the Hawaiian Islands by Captain Cook in 1778.

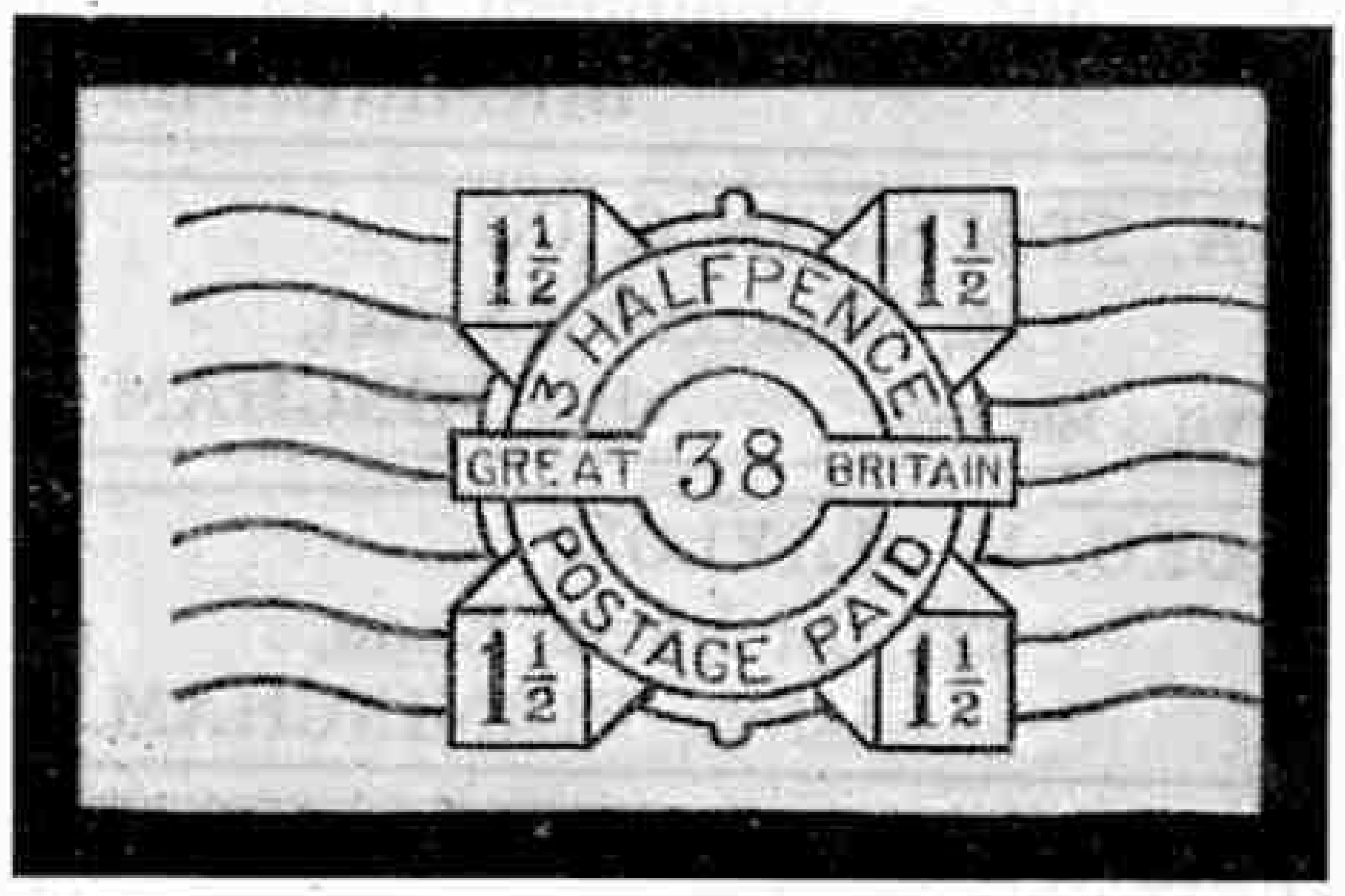
The current 2c. and 5c. rotary press printings, perforated 11 × 10½, were overprinted in two lines with the inscription "Hawaii 1778-1928." These stamps were first placed on sale in various post offices in the Hawaiian Islands, and on 13th August at the Philatelic Agency at Washington. The stamps were not available at other post offices in the U.S.A., but were available for postage throughout the States as well as in the Hawaiian Islands.

A similar overprint on the 2c. issue only, appeared on 20th October last to commemorate Molly Pitcher, the famous heroine of the Battle of Monmouth, which took place on 28th June, 1778. Molly Pitcher was the wife of the Commander of a battery of artillery, and when her husband was killed she took his place and continued to direct the operation of the guns. The overprint in this case also was in two lines.

We are indebted to Mr. B. Cadbury, Moorestown, N.J., for notes relating to these issues.

* * * *

Frank Meter Stamps



A new outlet for the enthusiasm of the collector is the collection of covers bearing the stamps of the new franking machines. These machines were first sanctioned for use in Great Britain on 5th September, 1922, and during recent years they have been freely adopted by large firms, owing to the considerable time and labour-saving advantage they offer. On the Continent also these machines are being used extensively, and South Africa has lately adopted them. It is possible that in the near future frank meters will be attached to ordinary letter boxes, so that by inserting a letter in one slot and a coin in another, and then turning a handle, the letter will automatically be stamped.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following four pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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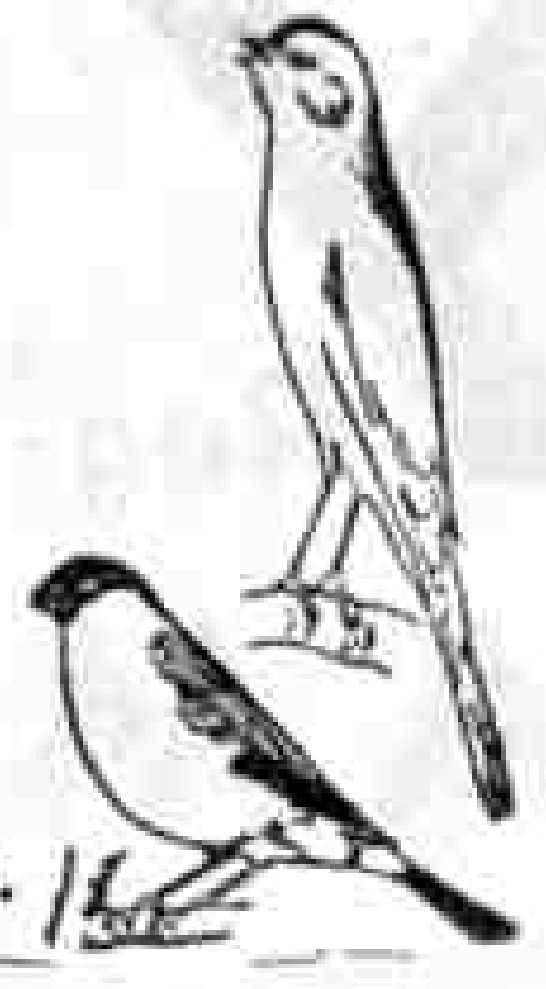

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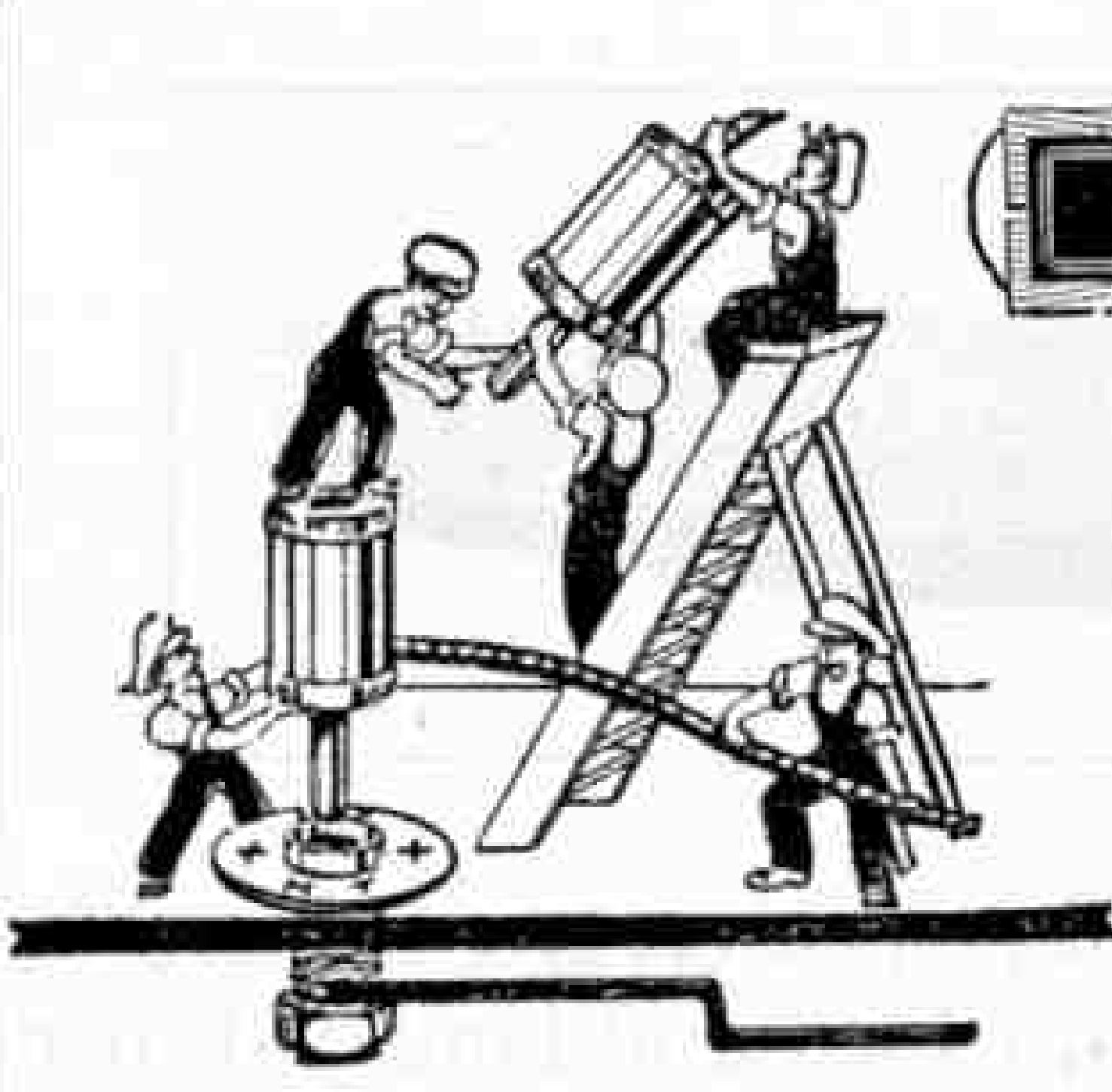

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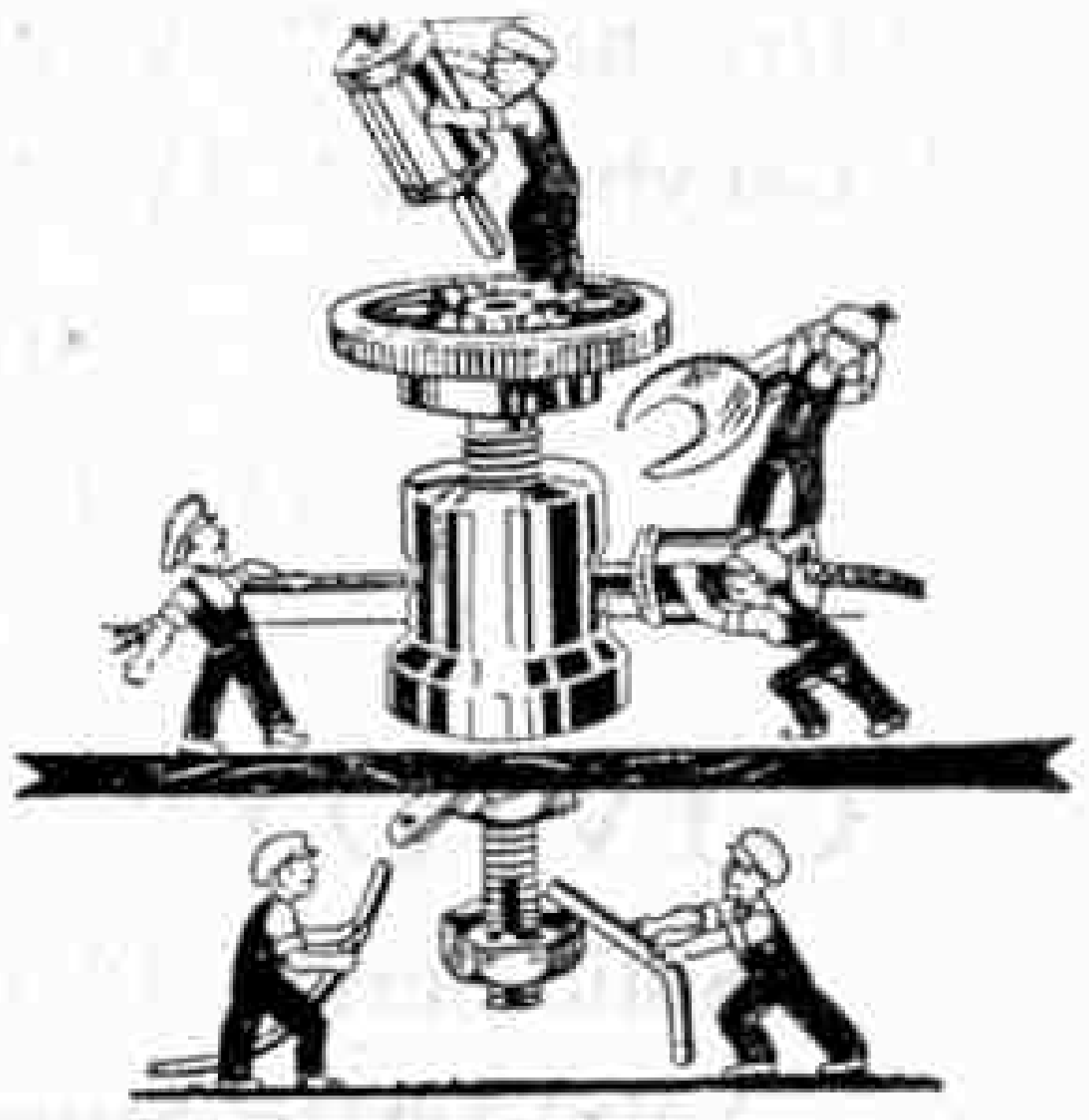

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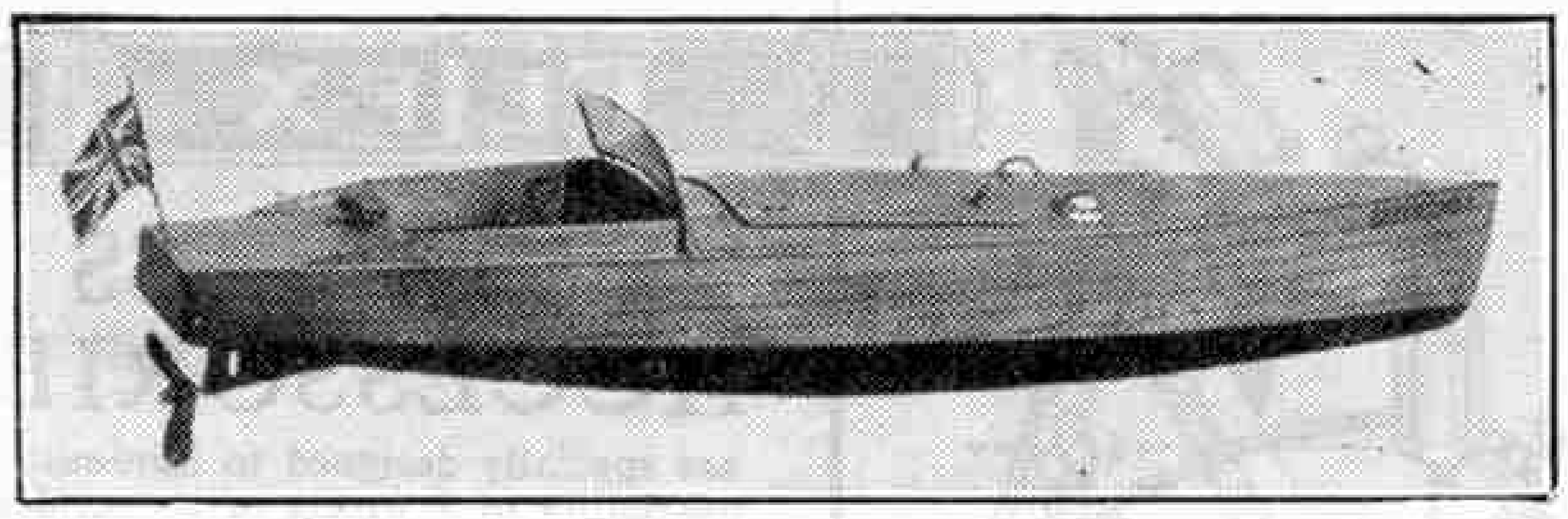

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"Greyhound" V, 21″ **17/6** } Powerful Clockwork.
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"Greyhound" III, 25″ **25/6** – Electric 1 Speed
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Stream Lined, Mahogany, Unbreakable Spray Screens, Highly Finished.
The Brass Propellers are specially designed for speed. Each Boat Guaranteed.

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Solid Series, Plain Sails ... ... **1/3, 1/9** and **2/6** each
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For Design and Efficiency—The

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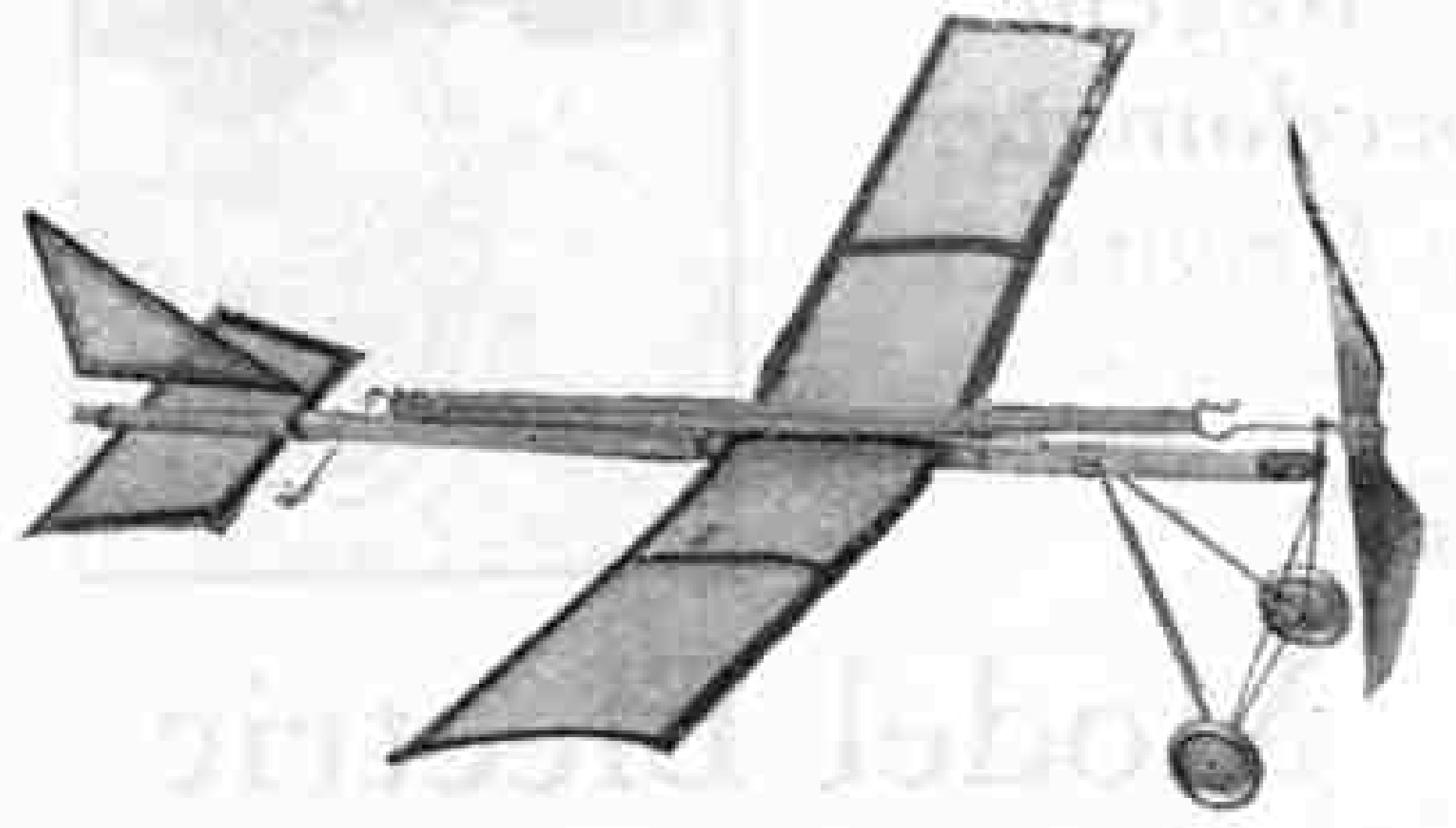

Our Famous No. 5
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Note Size—Wing Span 21 in. Length 20 in. Flight 100-150 yds. Despatched in strong box with full instructions

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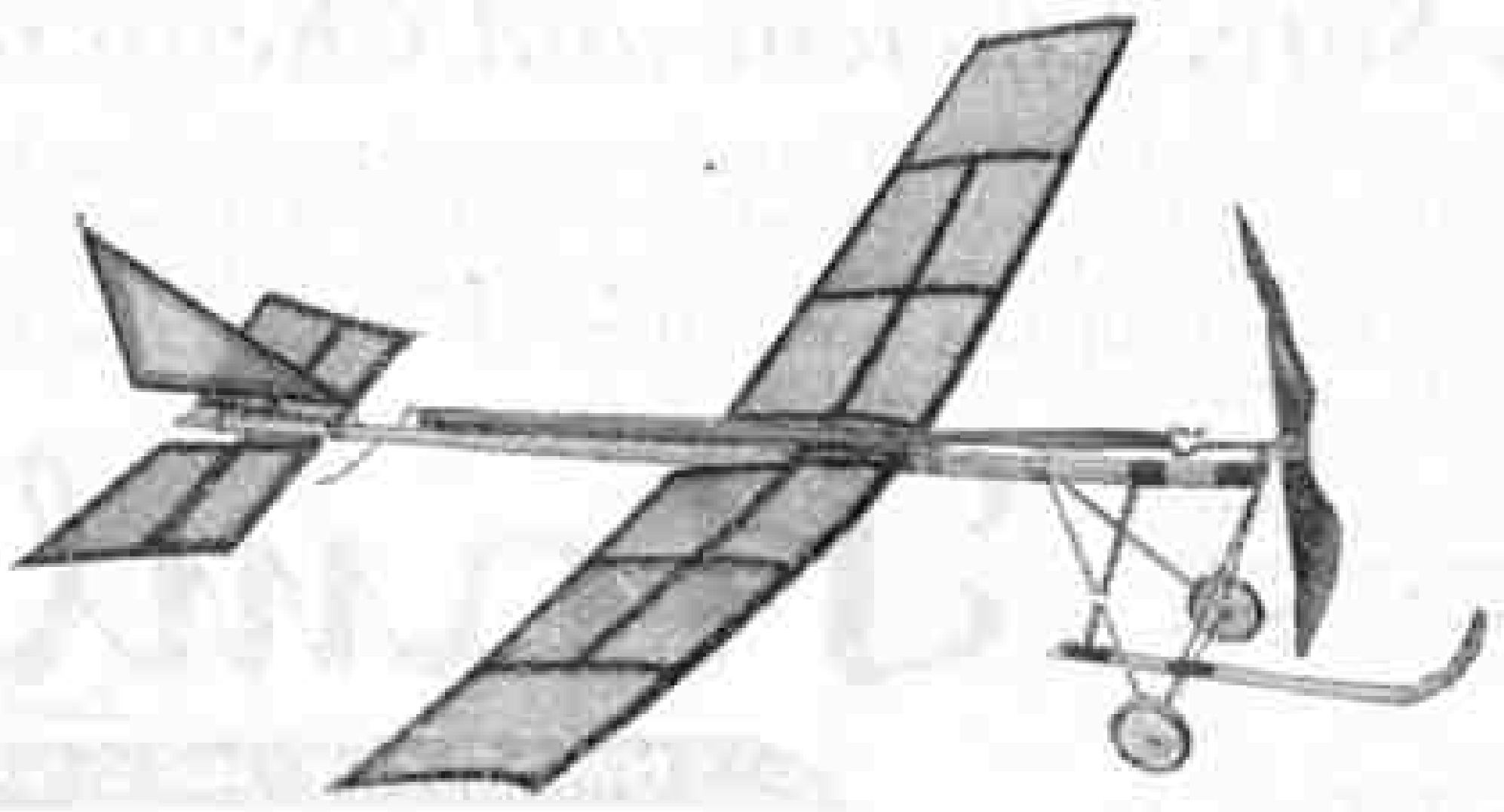

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	No. 0 Price **18/6**	No. 2 Price **10/6**	No. 4 Price **6/6**
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The **"Skisail" Monoplanes** are designed on correct aeronautical lines, constructed with highest quality materials and are fitted with our **Patent Safety Chassis and Bamboo Runners,** a distinctive feature which makes them superior to any other type on the market.

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Model Makers to the British Admiralty

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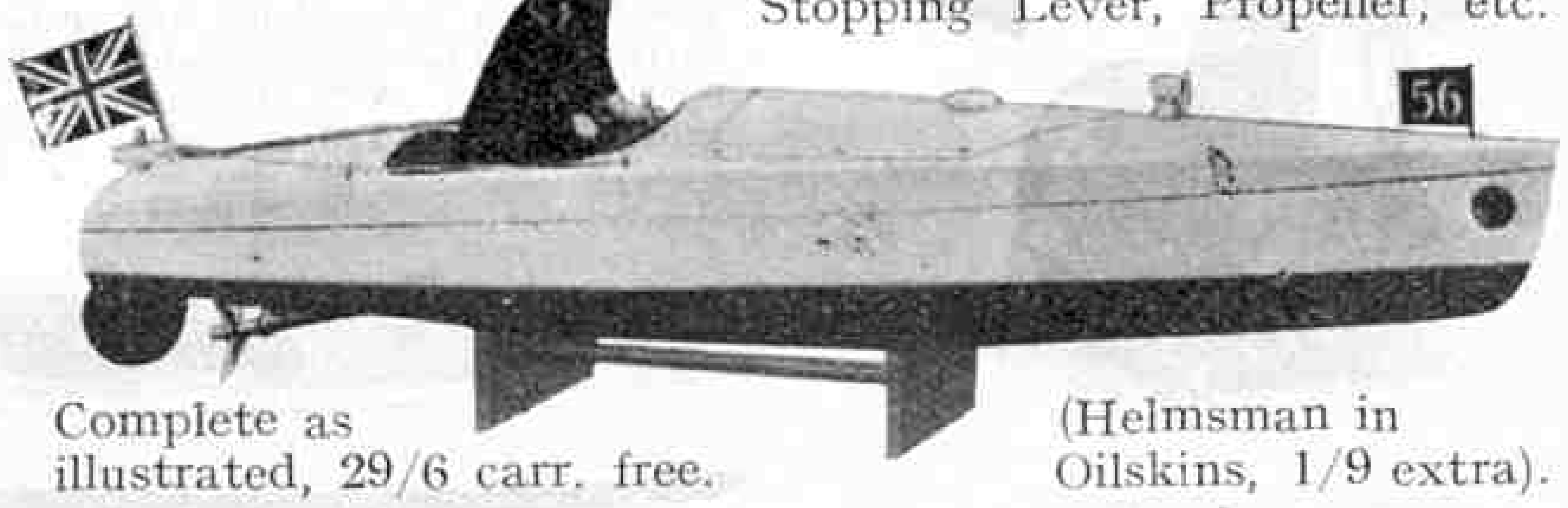
Racing Motor Boats

These Motor Boats are made of Finest African Mahogany, beautifully finished and painted, with Turtle Deck, Steering Wheel, etc. Complete with powerful Clockwork Motor with Starting and Stopping Lever, Propeller, etc.



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(Helmsman in Oilskins, 1/9 extra).

Motor Boats similar make to above, with strong Clockwork, Brass Propeller, Rudder and Helm, etc., **6/6, 10/6, 13/6, 22/6, 160/–** each, carriage free.

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Length of Deck only, 17″	**10/3**	Length of Deck only, 24″	**26/9**
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ARGYLL ARCADE, GLASGOW

The last word in Motor Boats

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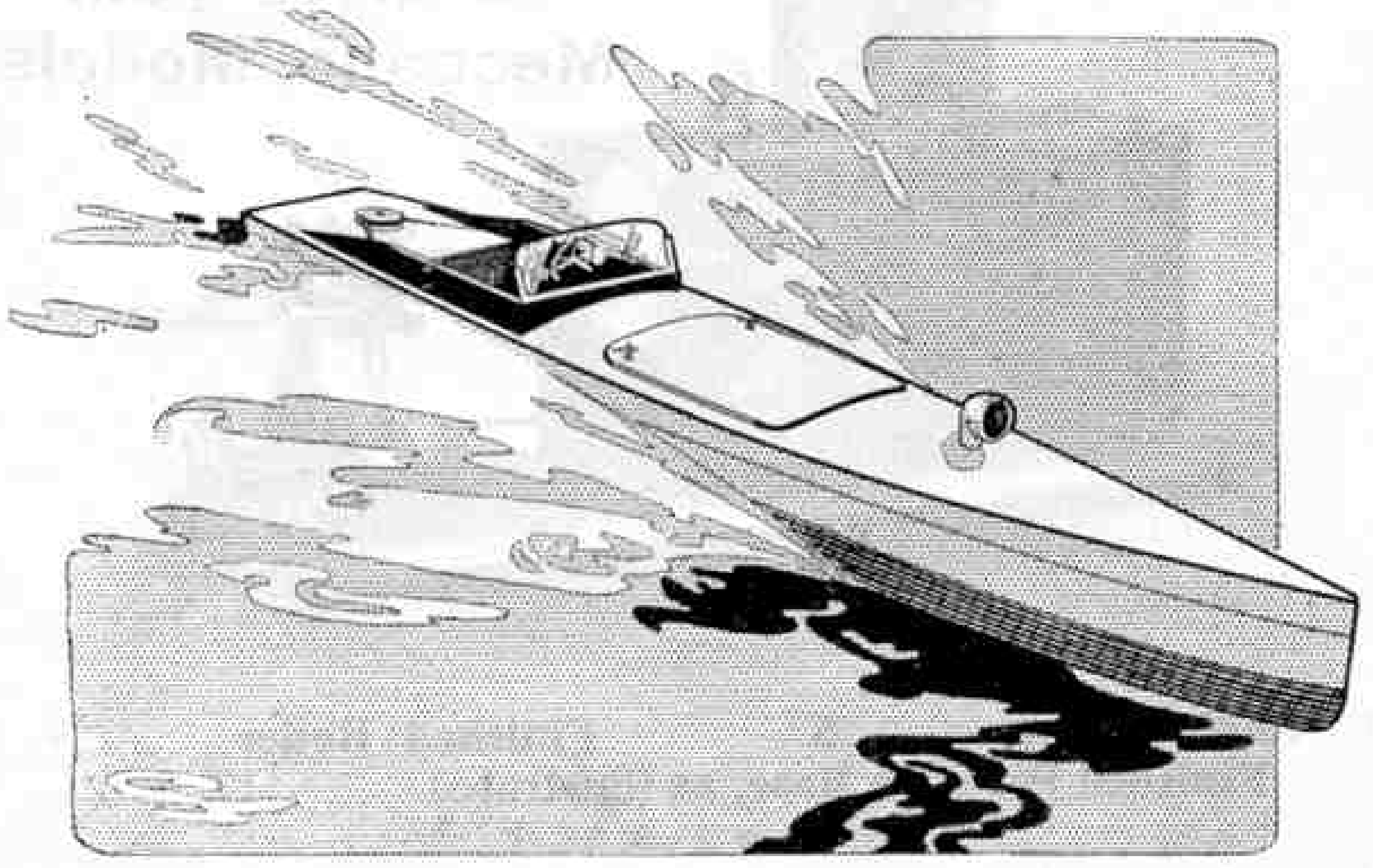

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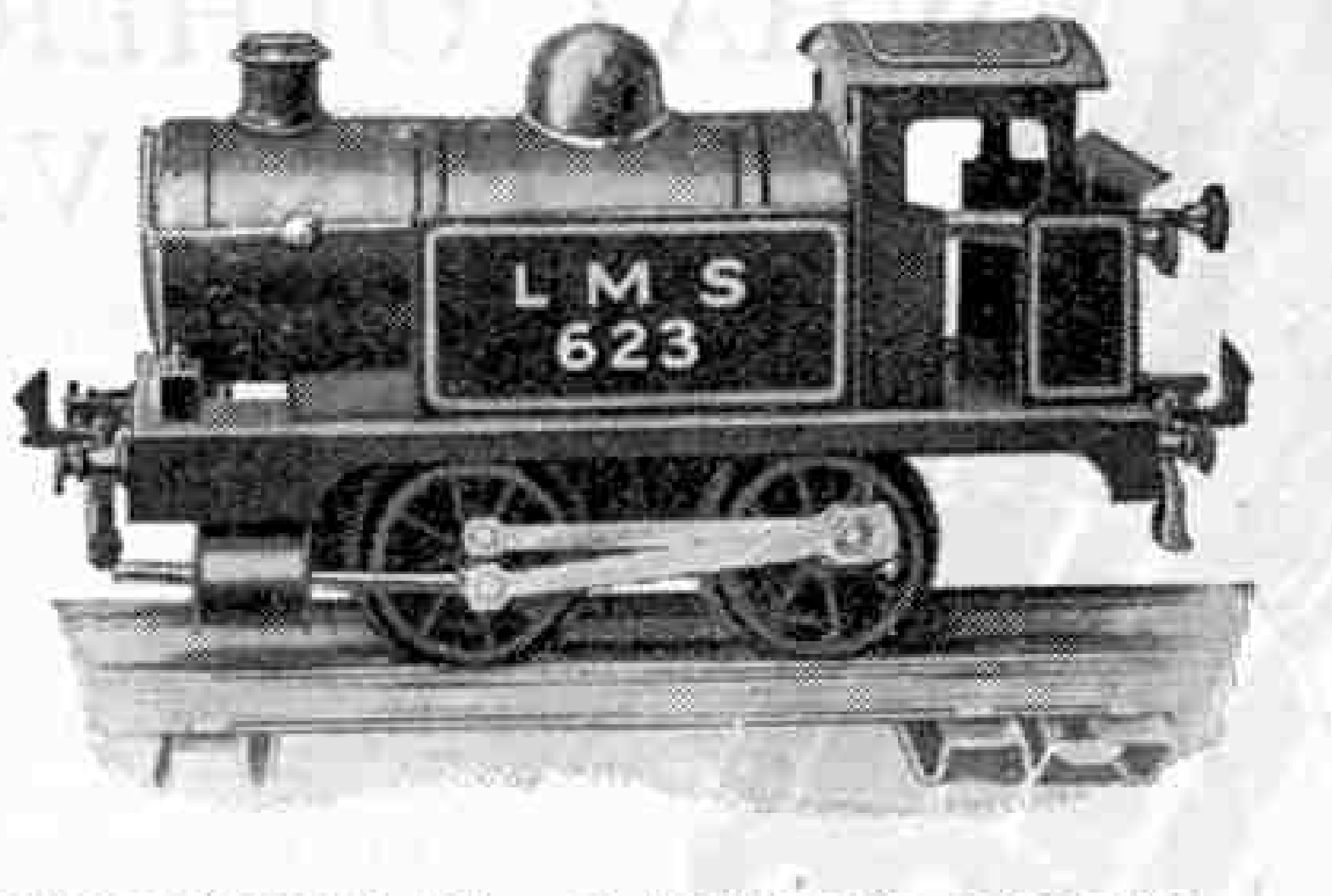
HORNBY TANK LOCOS



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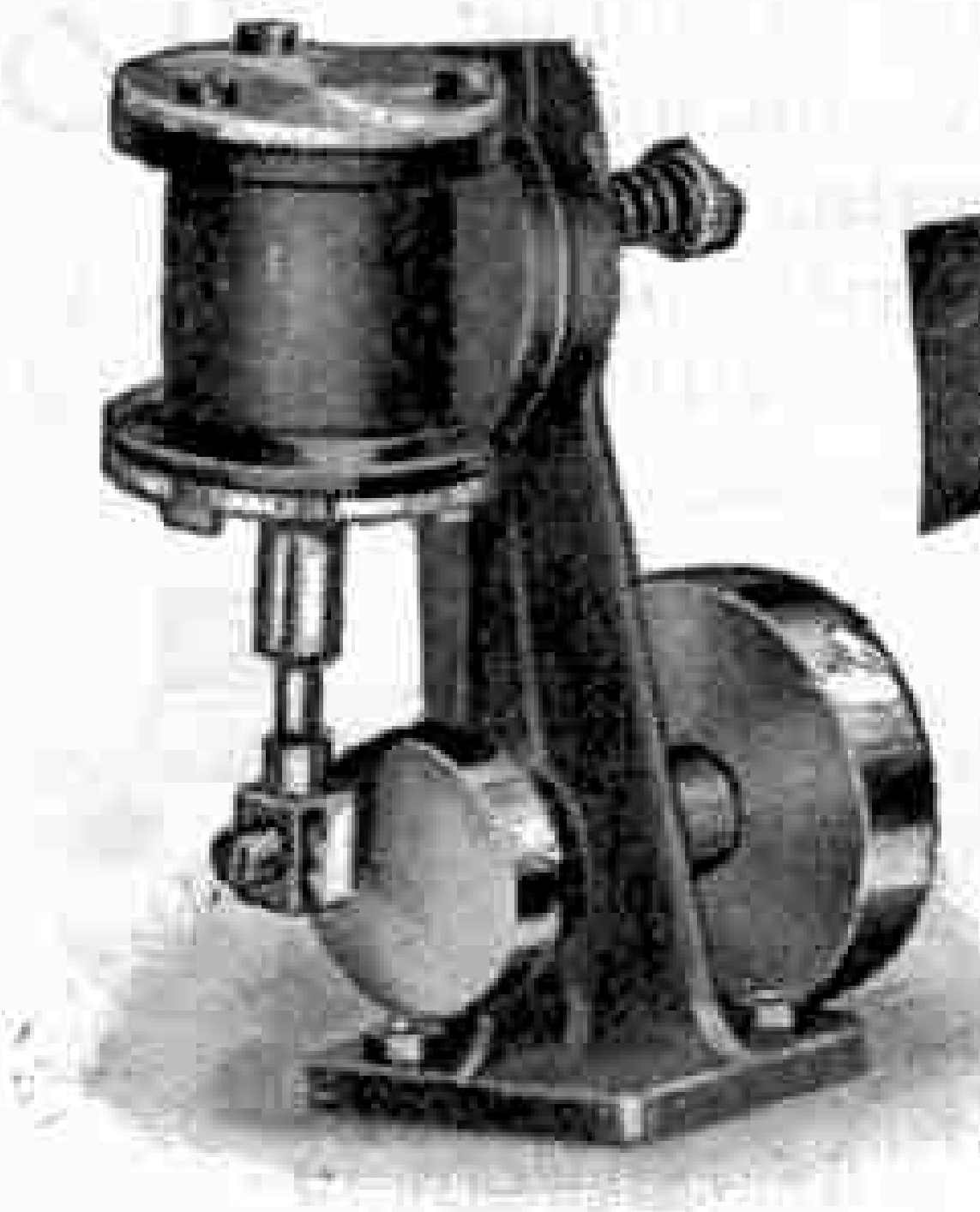

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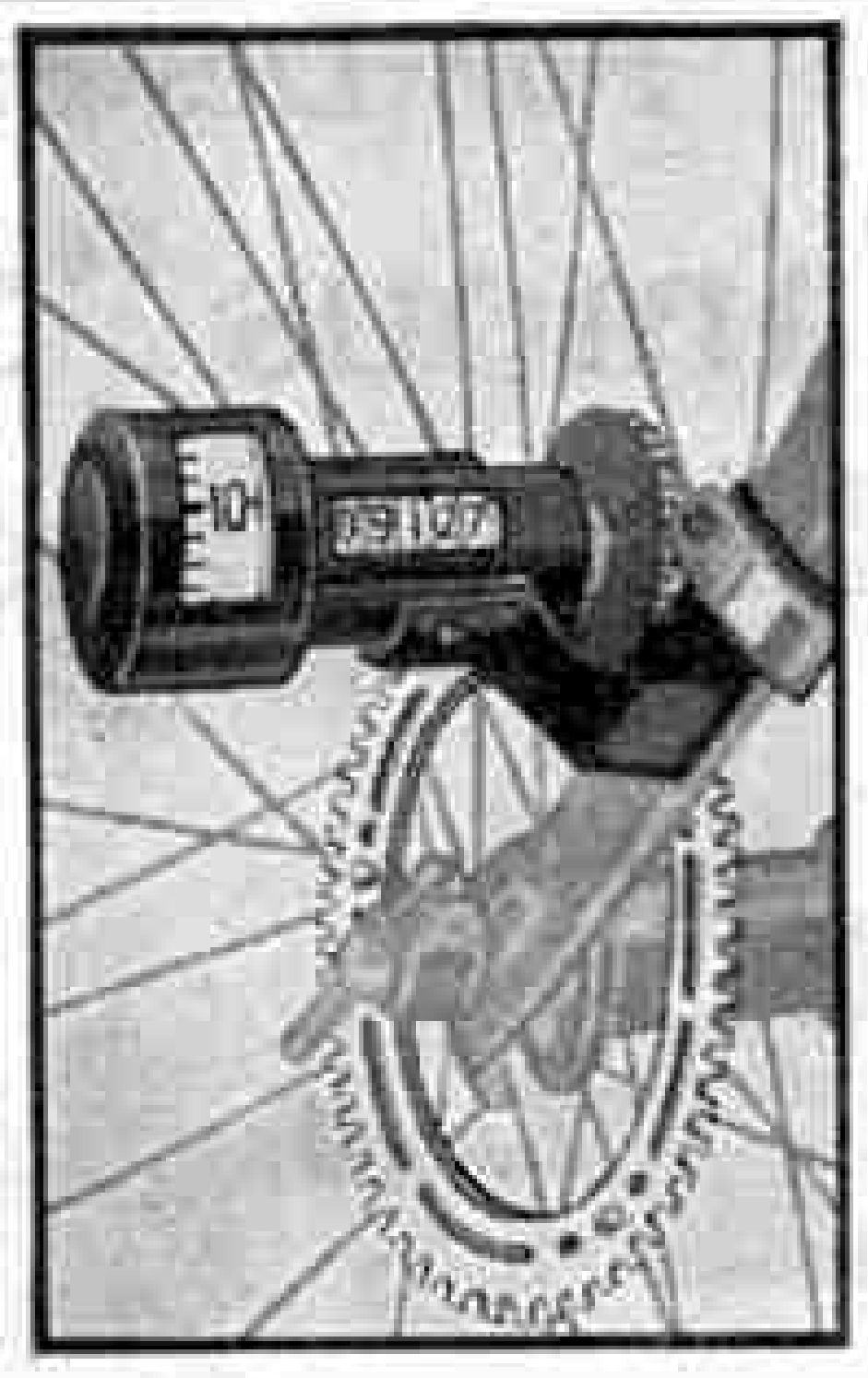

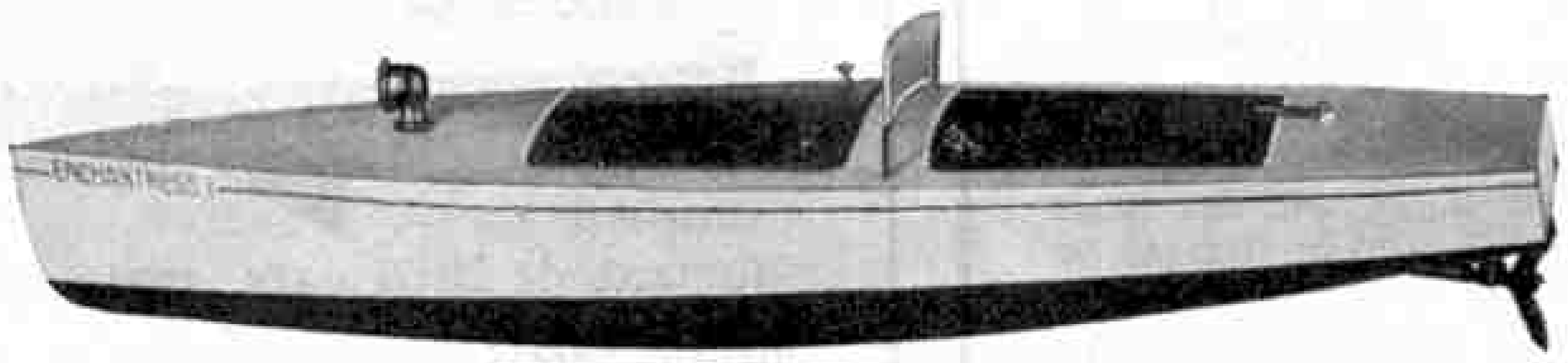

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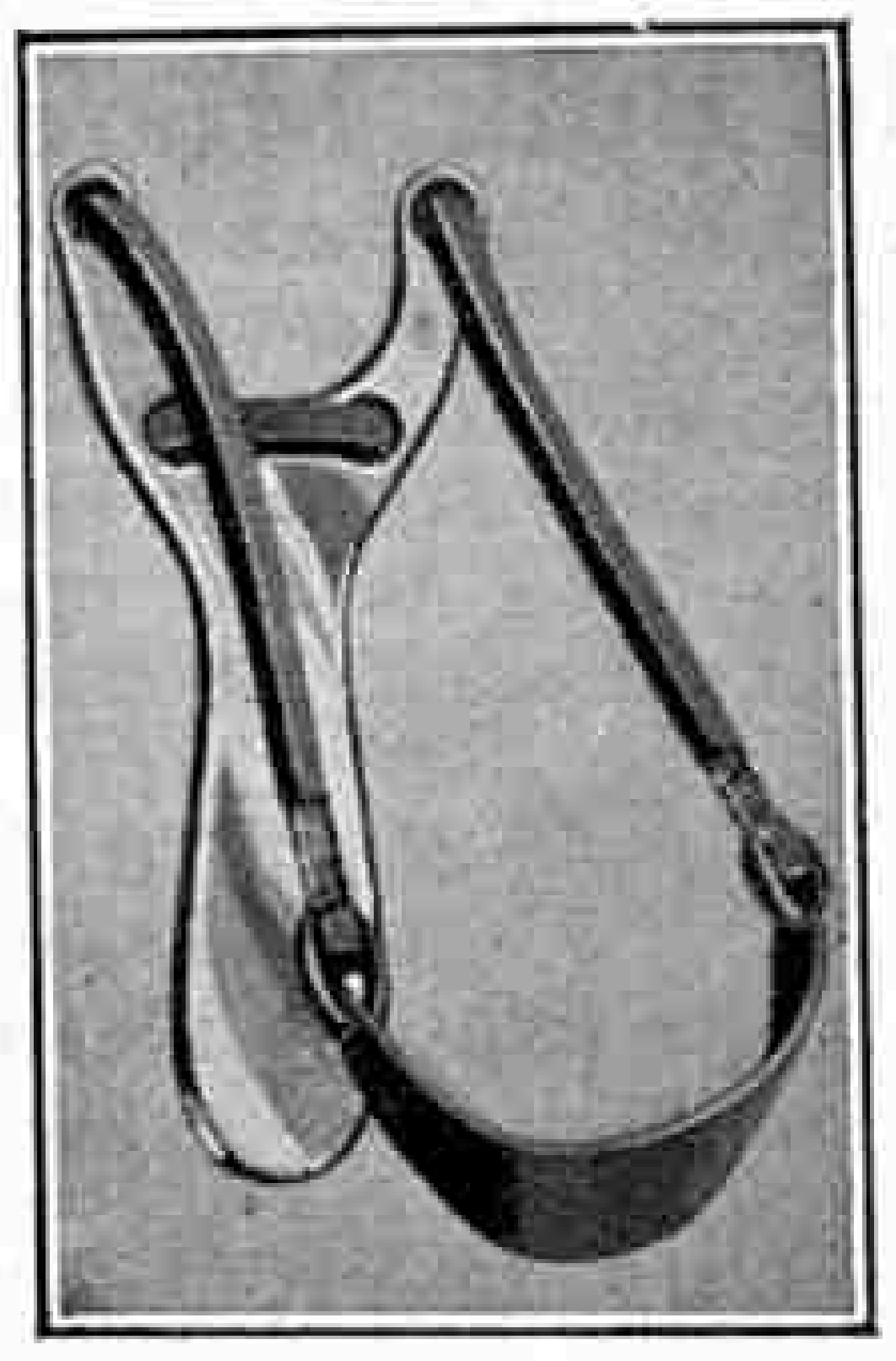

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P.R.11	3.5—4	.063	88000	40	R.C.
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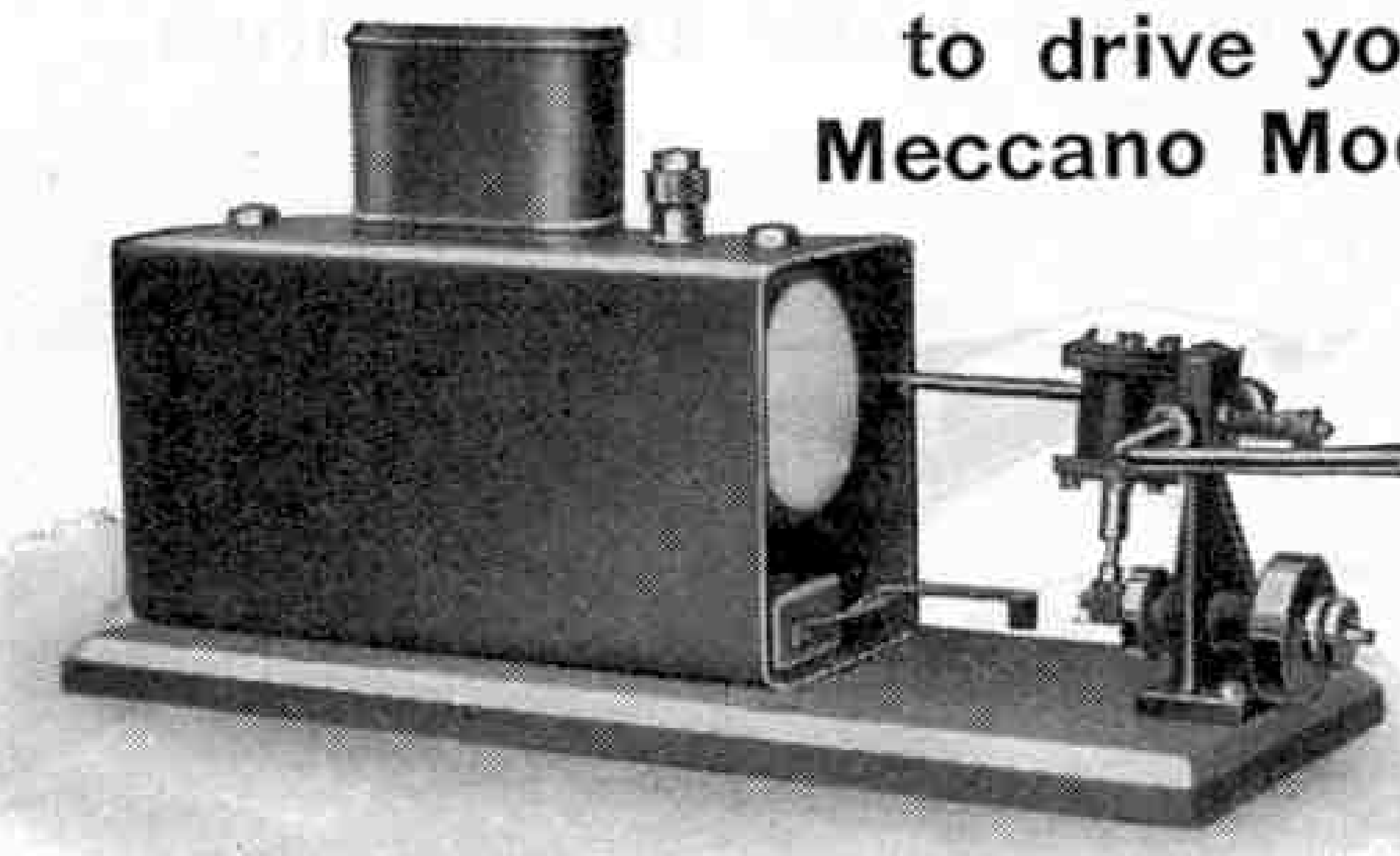

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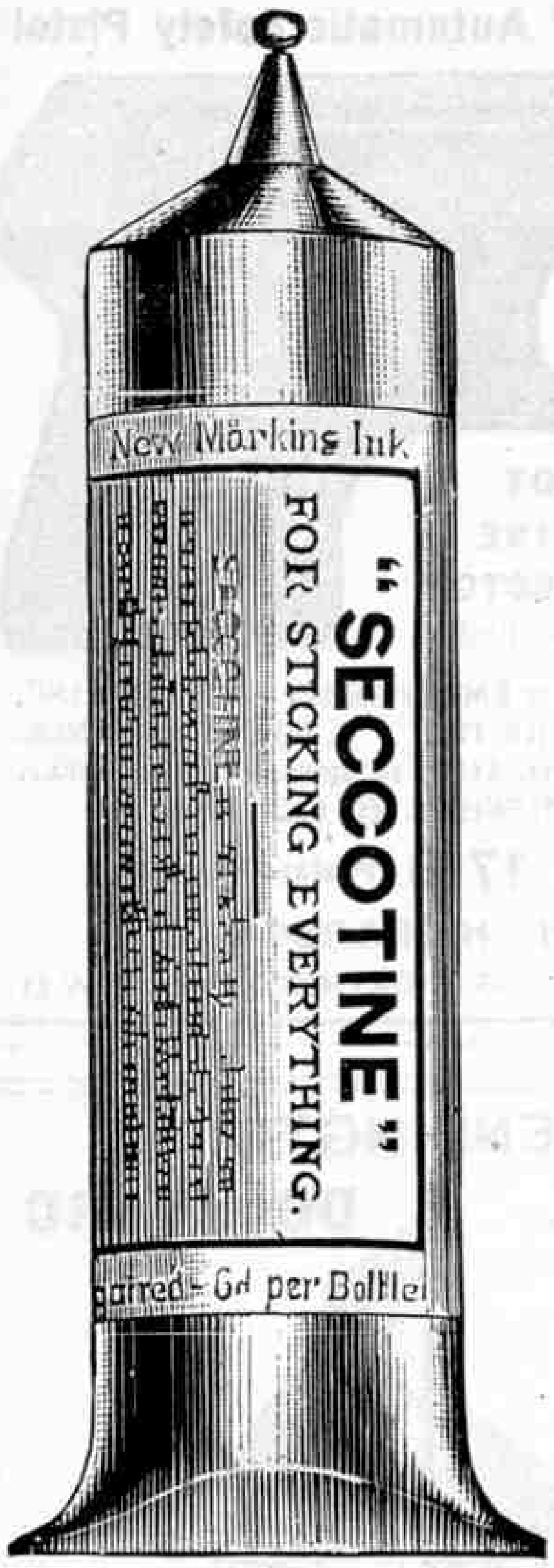

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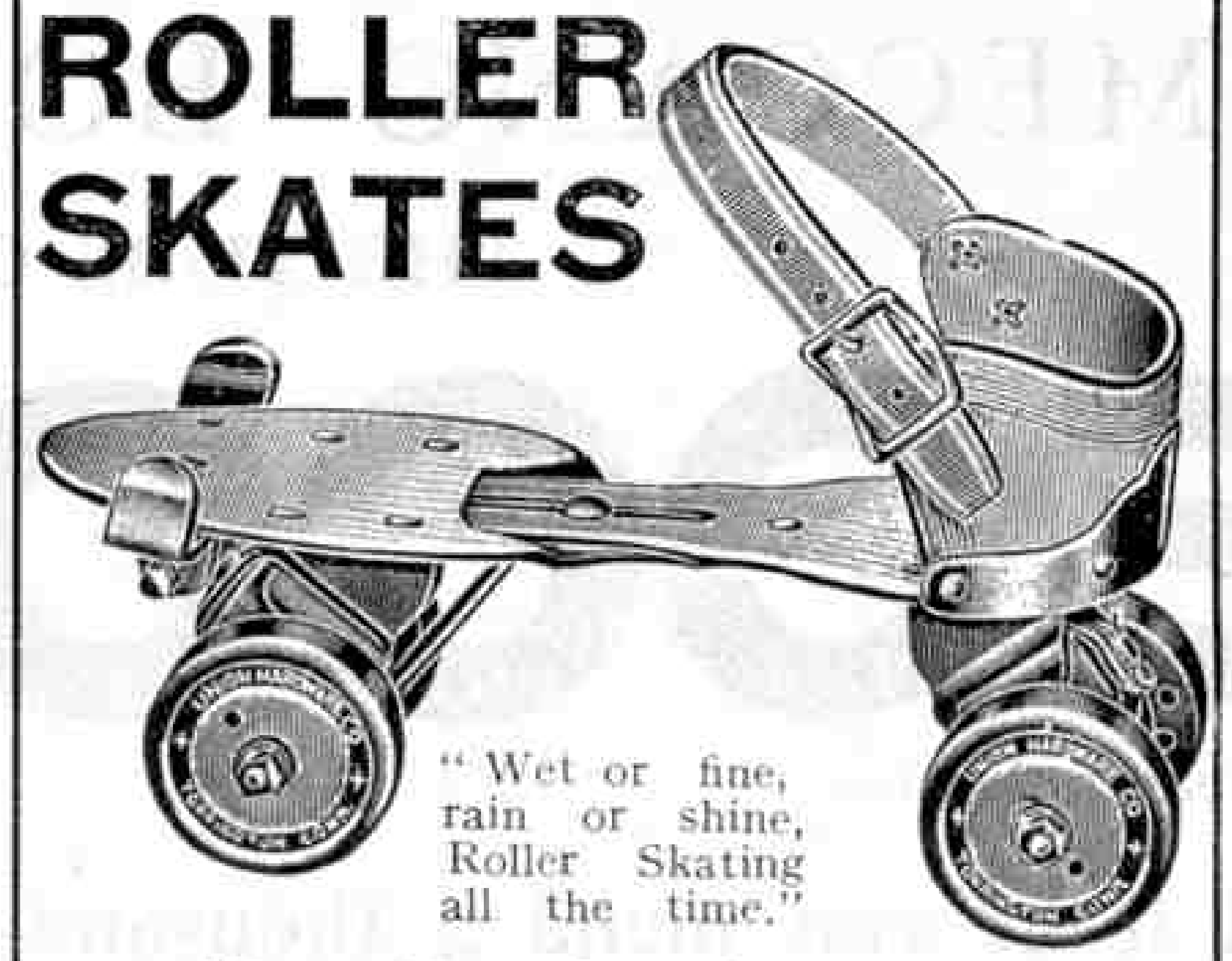

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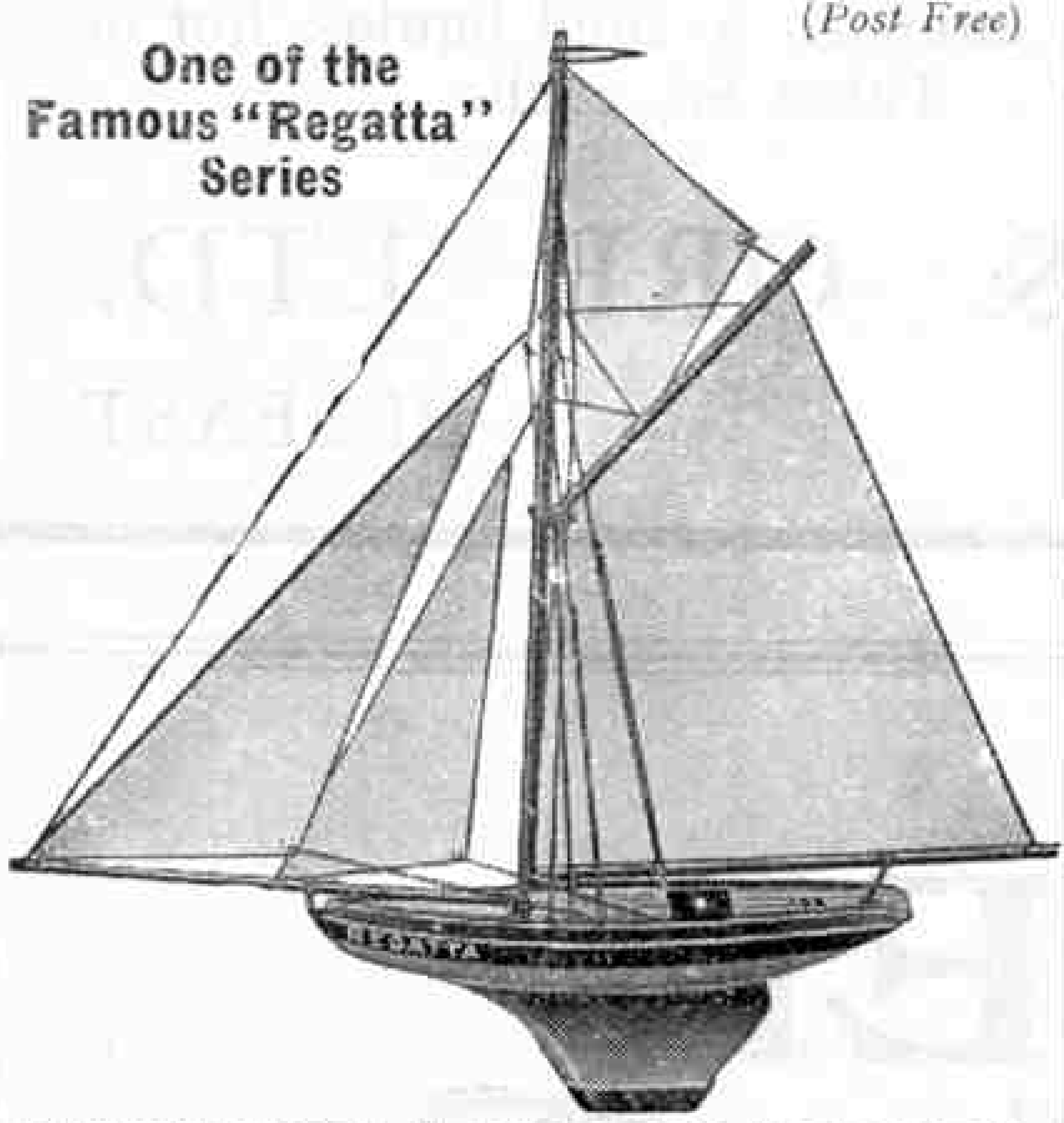

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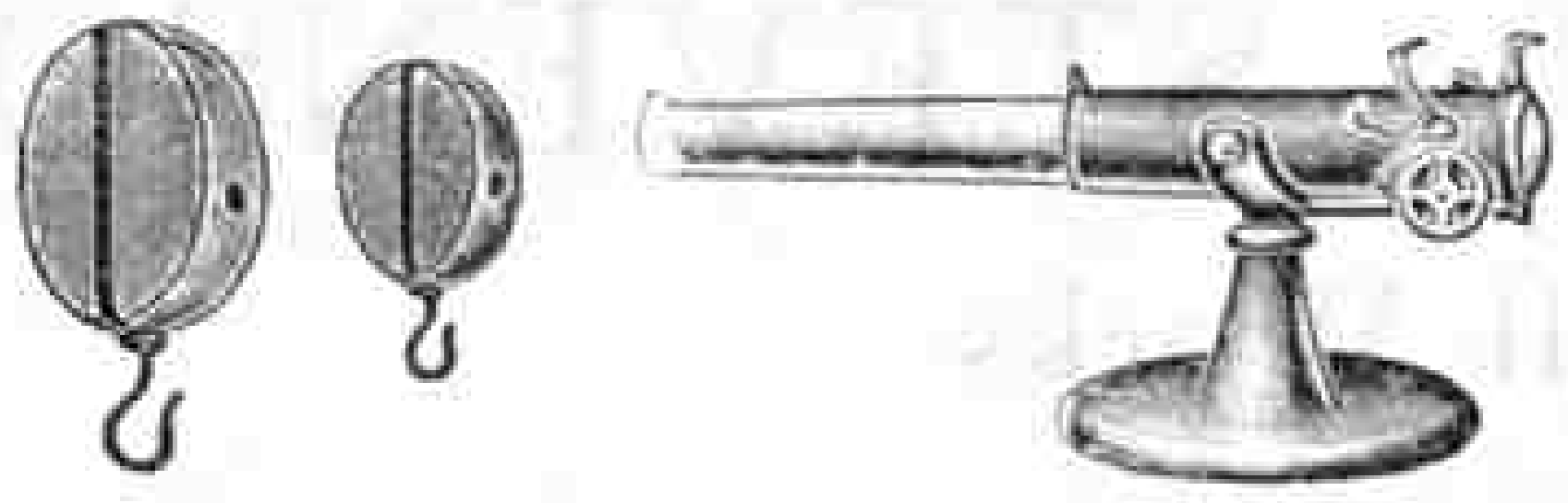

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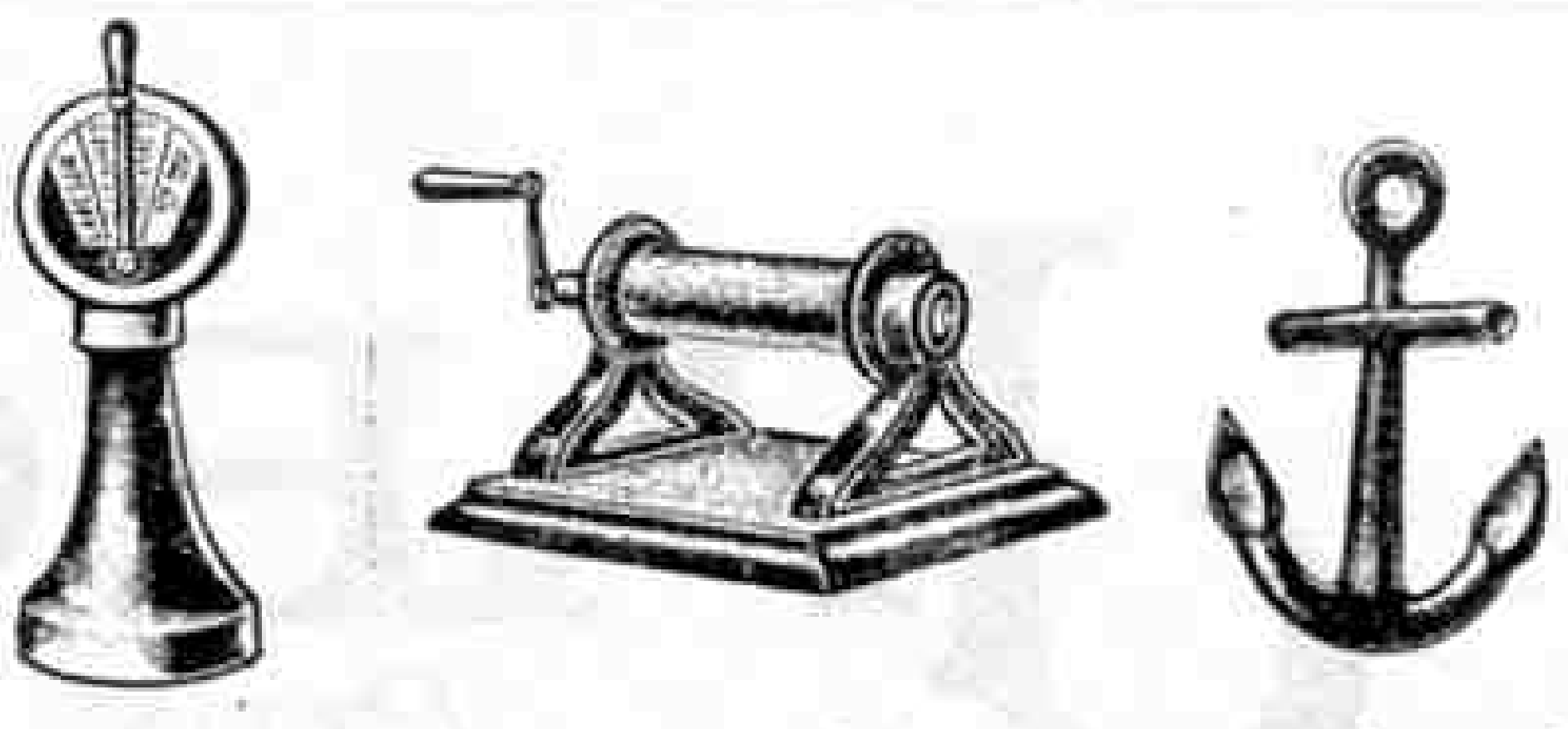

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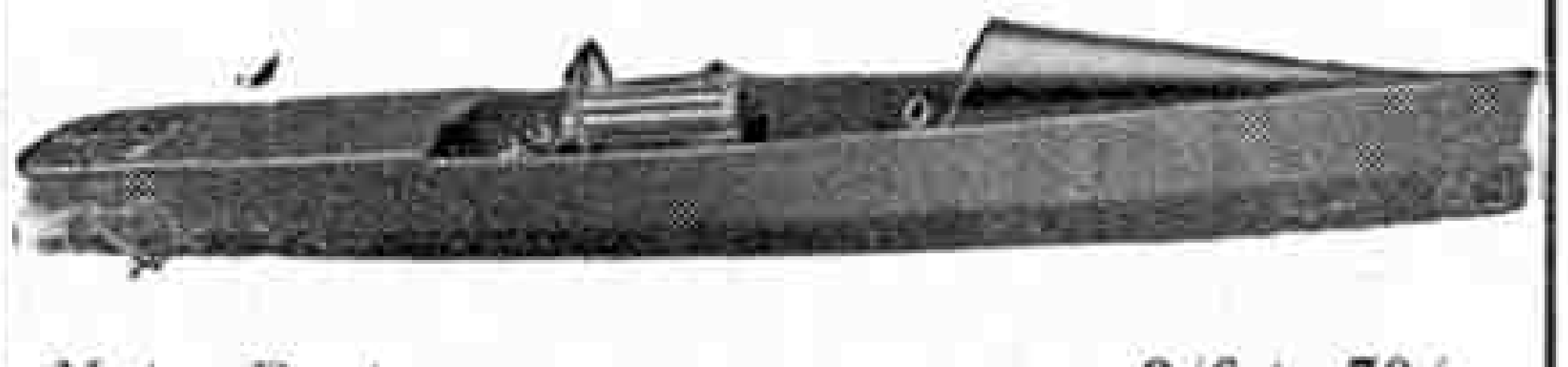

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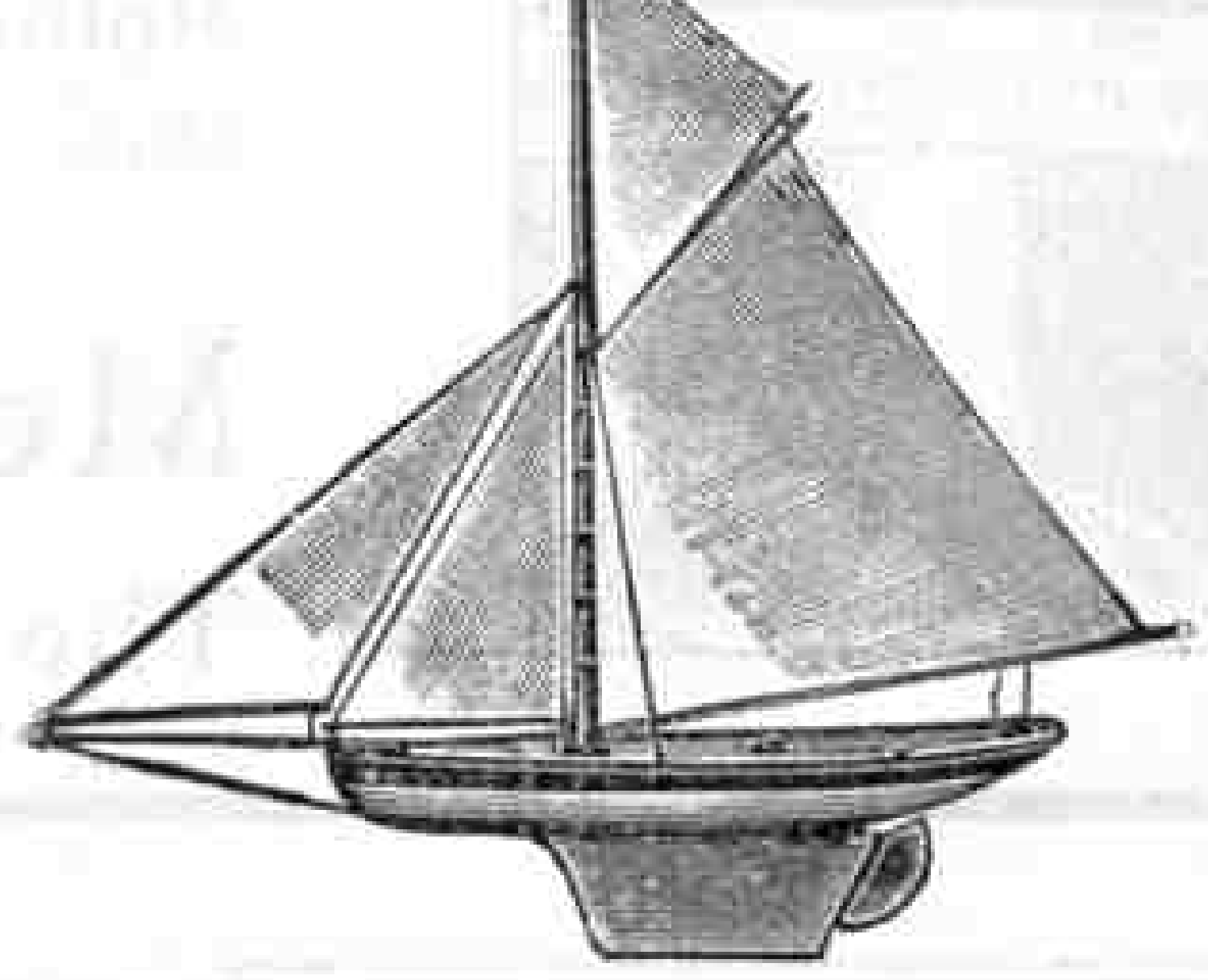

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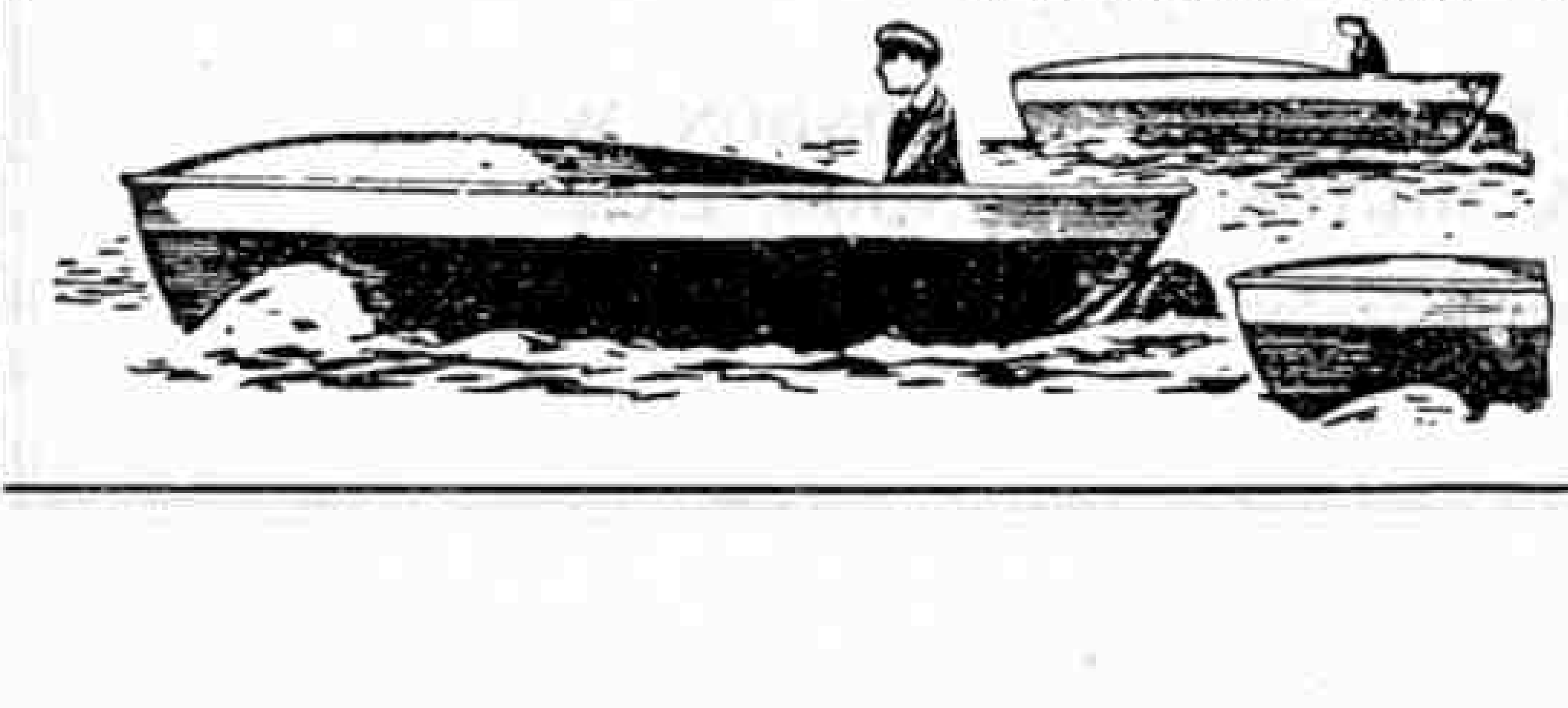

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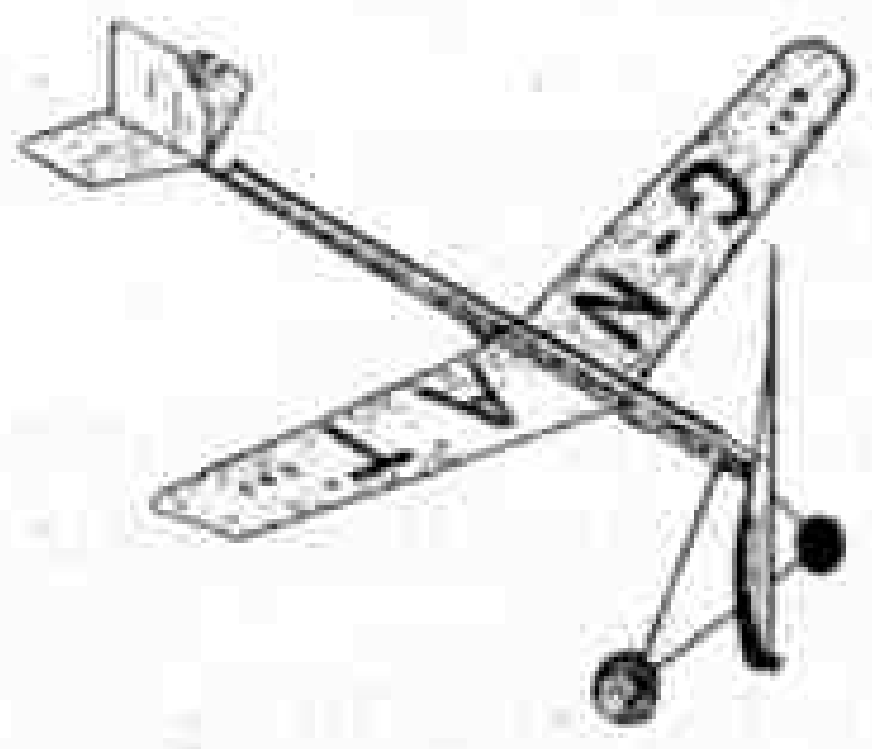

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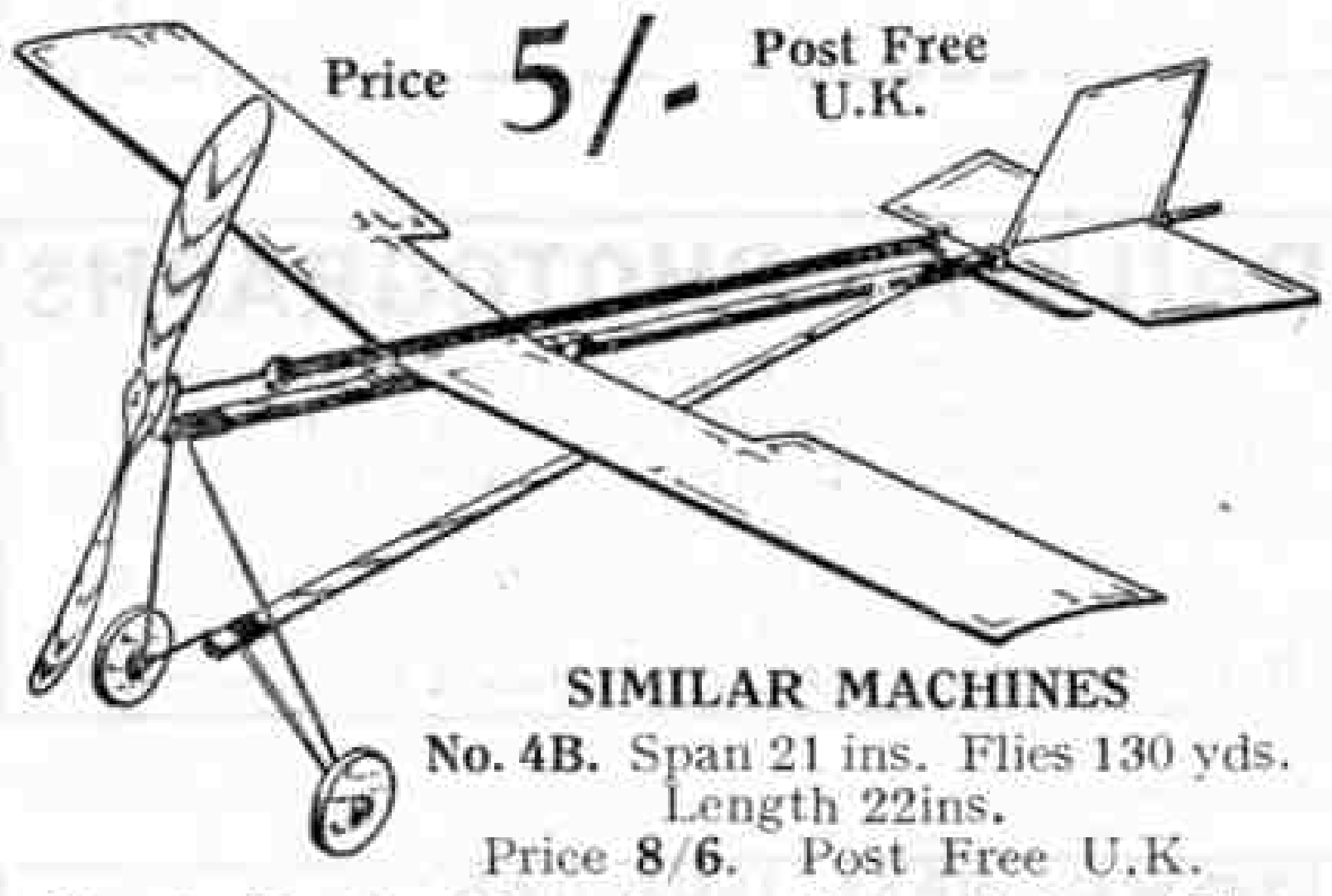

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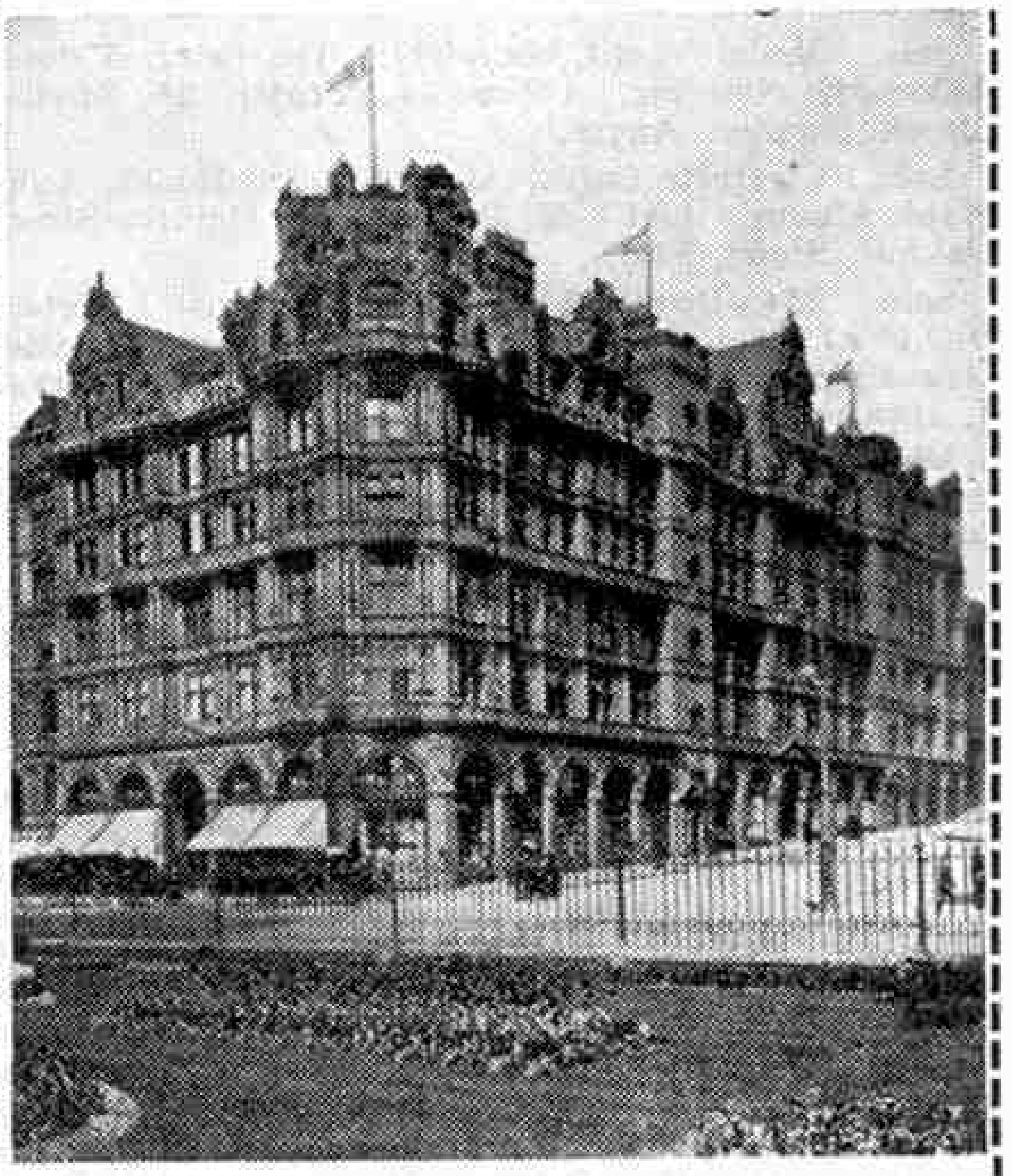

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Wanted. Complete set "M.M.," 1925-1928. State condition and price. Box 404.

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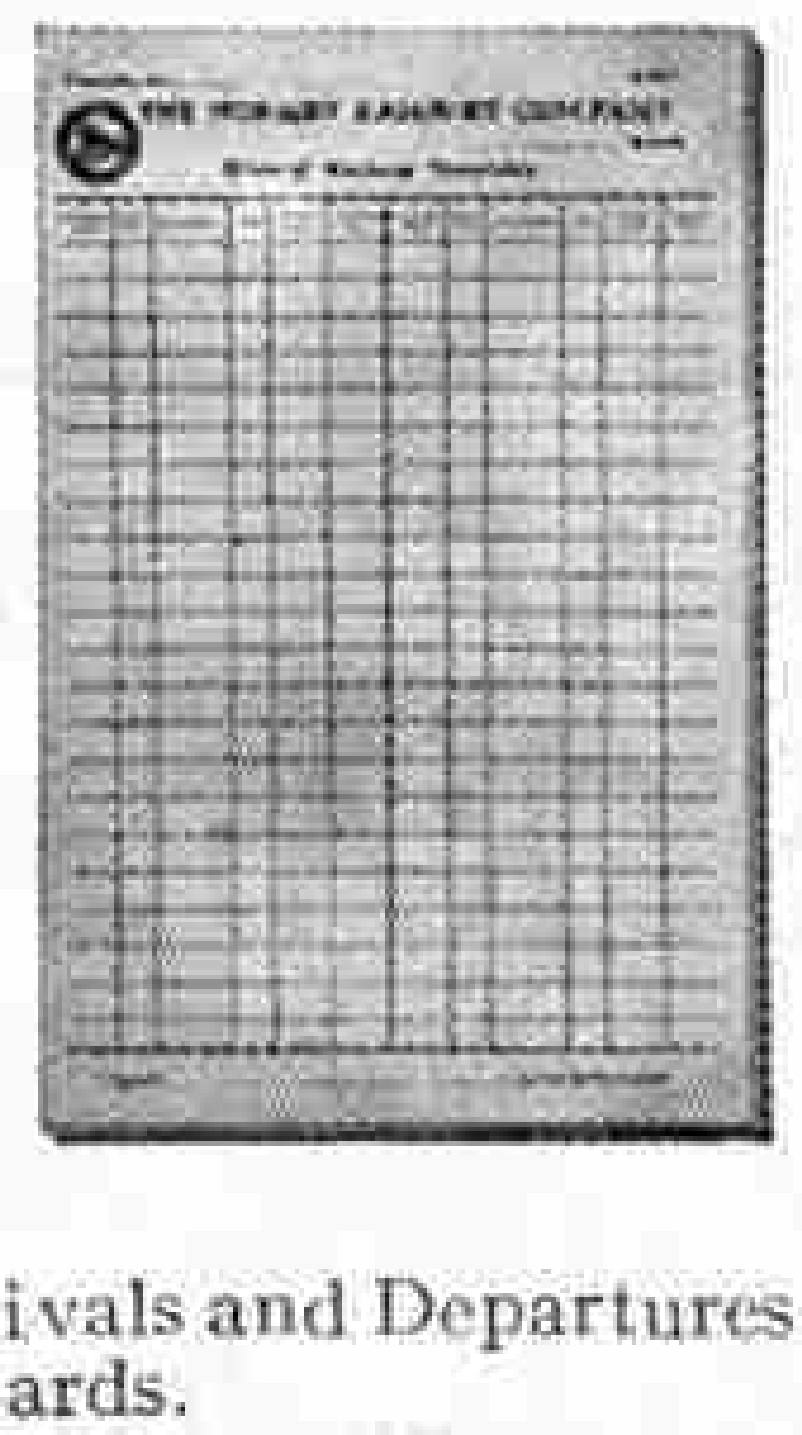

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Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office. 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

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Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/– per copy (postage extra), and the subscription rates 7/– for six months and 14/– for 12 months (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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AUSTRALIA: Messrs. E. G. Page & Co.,
52, Clarence Street, Sydney, N.S.W.

NEW ZEALAND: Models Ltd.,
Kingston & Federal Streets, Auckland

SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199)
142, Market Street, Johannesburg

INDIA: Karachi: Bombay Sports Depot, Elphinstone Street.

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The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the correct figure. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor. The name of the nearest Meccano dealer who is willing to supply at the correct figure will then be given.

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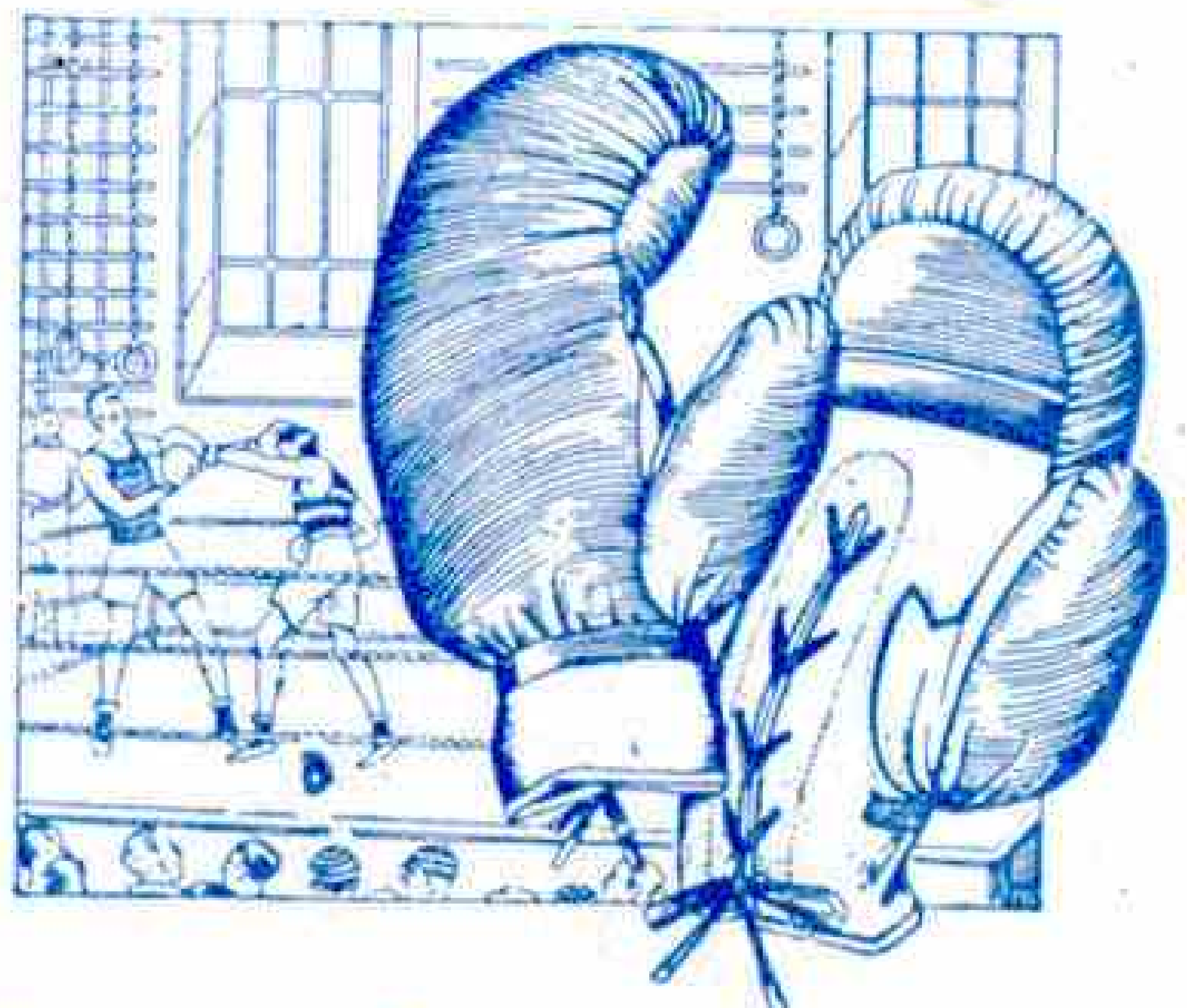

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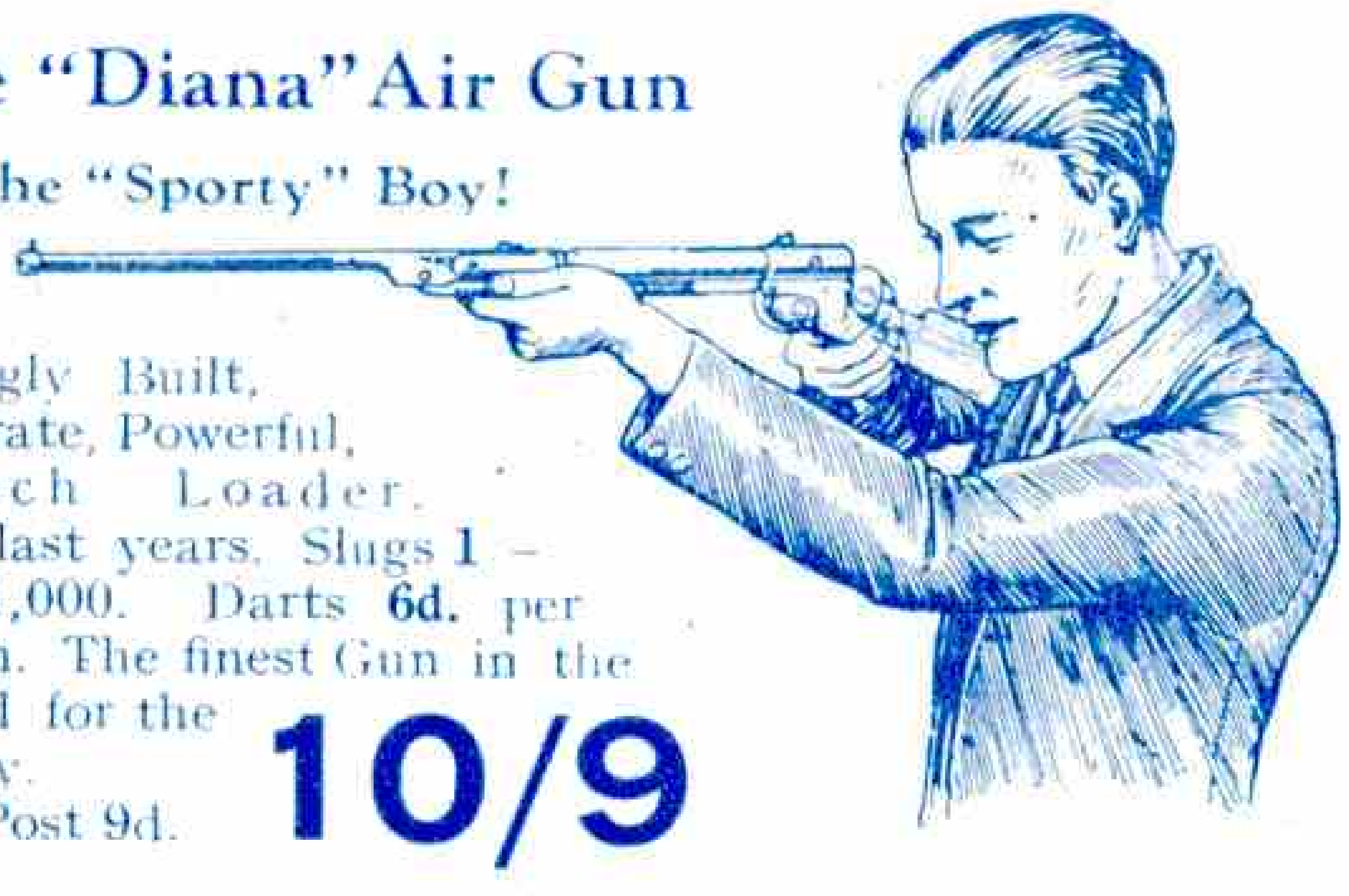

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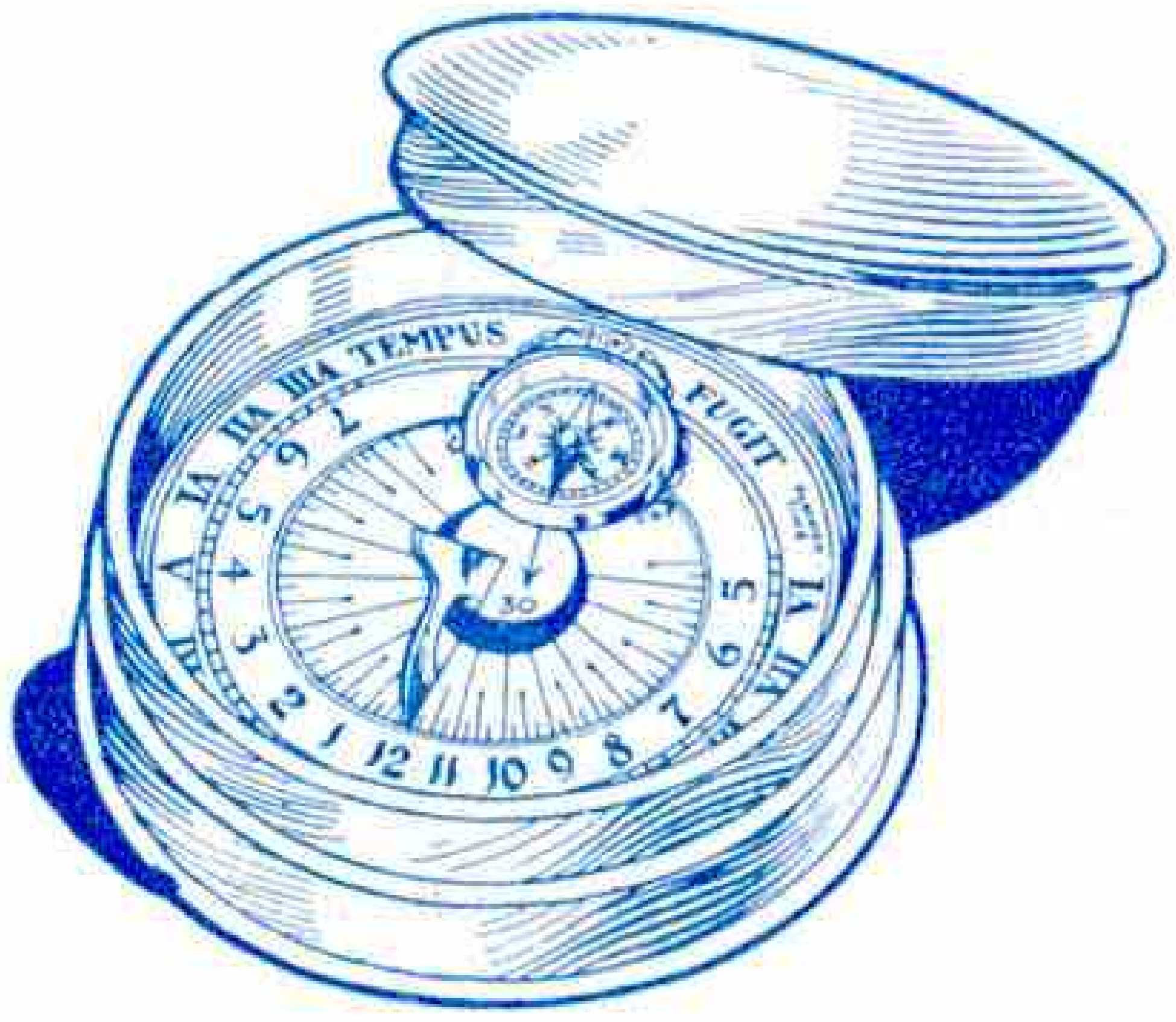

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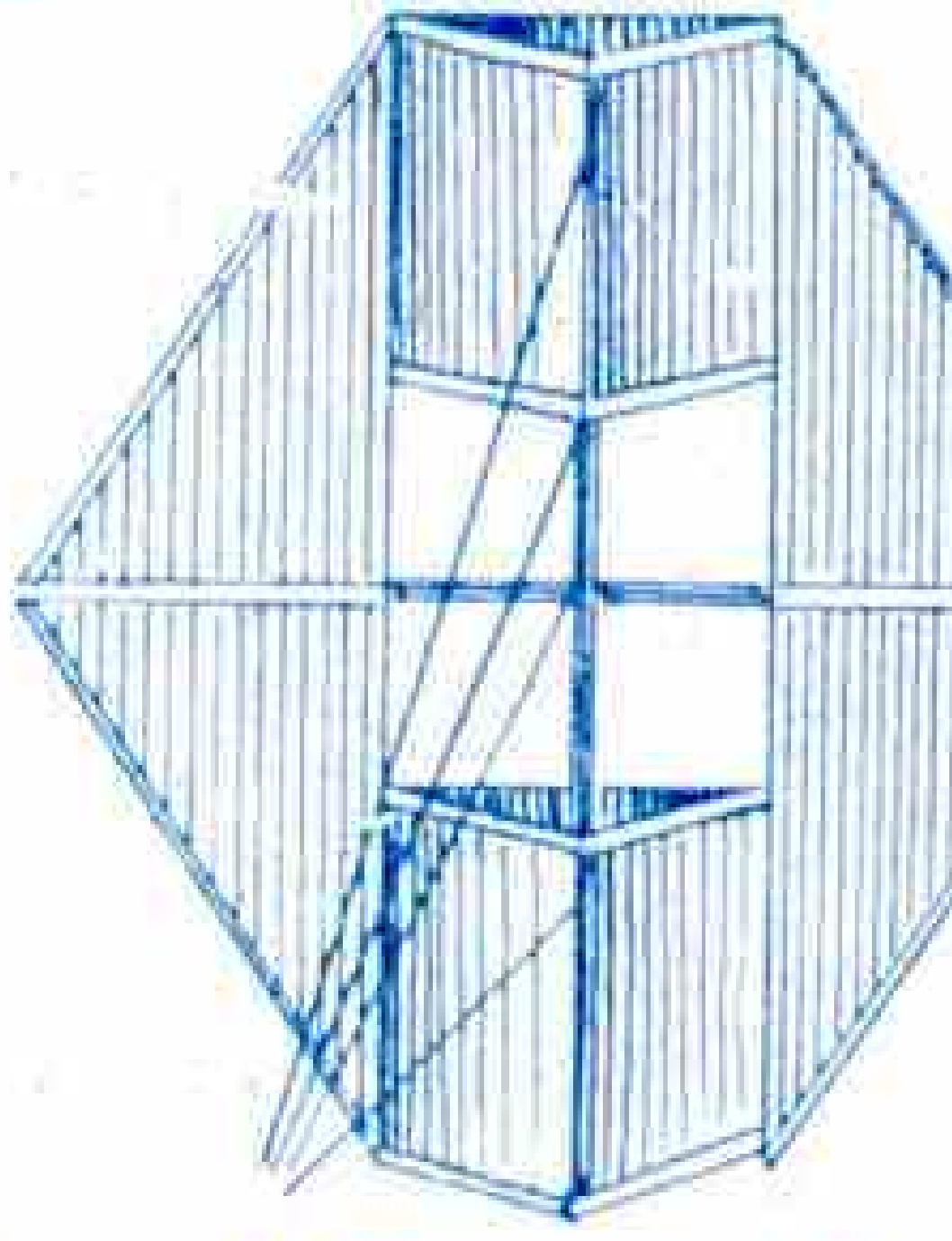

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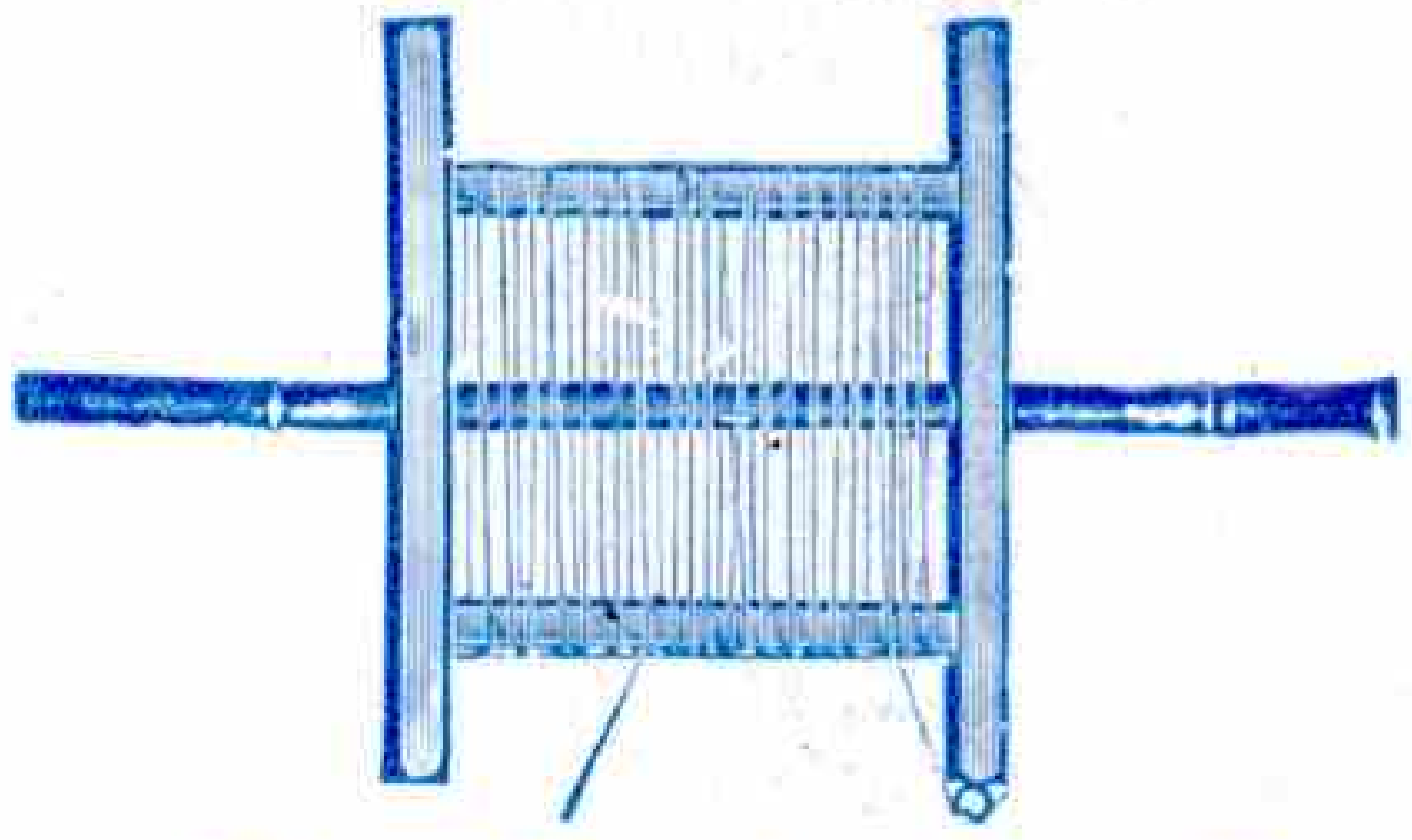

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Post	2d.	4d.	5d.

Supersedes the old style, and cord can be wound up very quickly.

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Lamp board (with lamp holder and switch) Price **4/6**

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4-volt 8 amps.	Price **17/6**
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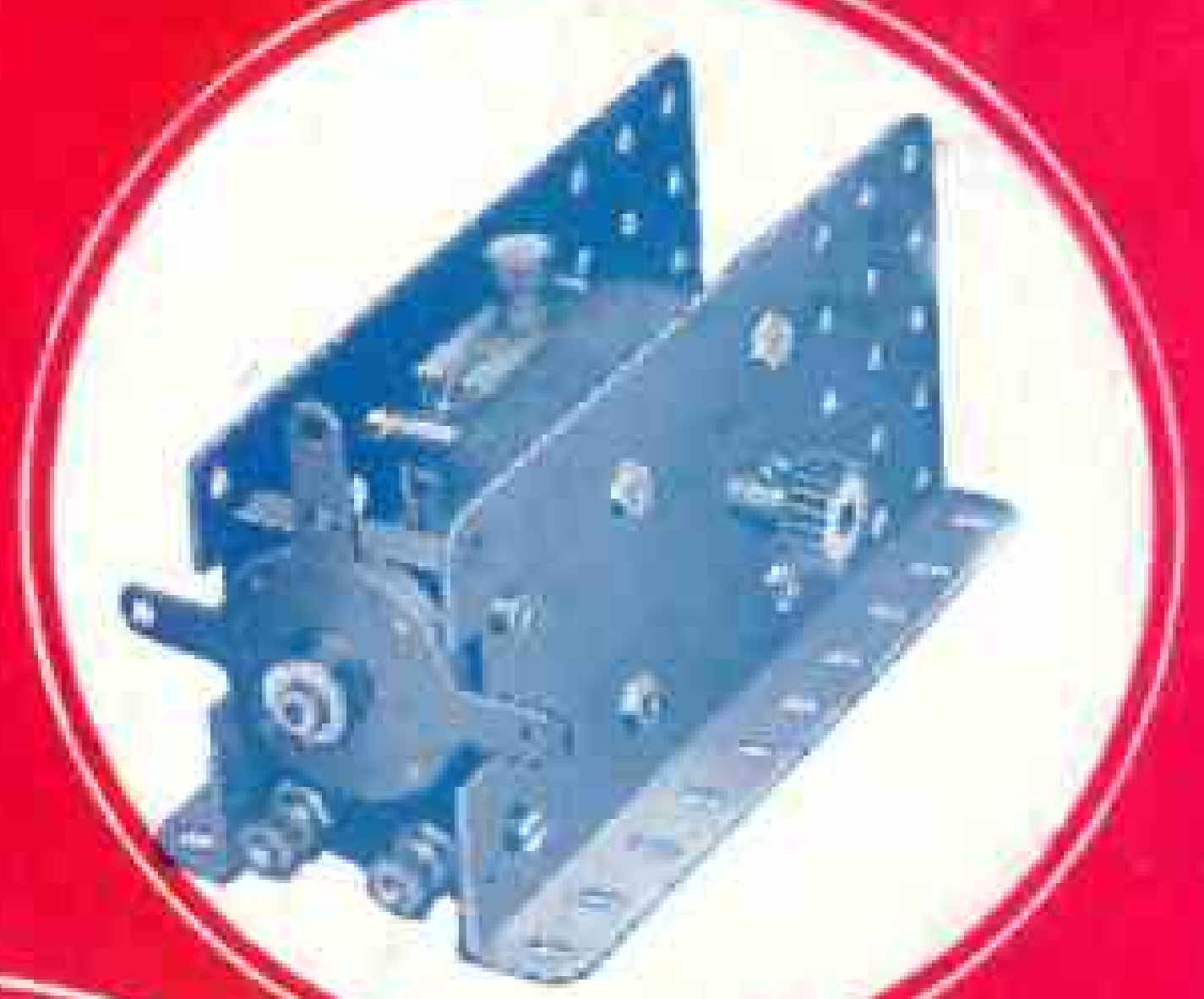
This Meccano Model

is fitted with the patented Meccano Reversing 4-volt Electric Motor and actually pulls a boy weighing 140 lbs. along the ground with ease.

The reason is that Meccano Parts are strong enough to carry the weight and the Meccano Motor, the most powerful toy motor in the world, is strong enough to pull the load.

Run *your* Models with a Meccano Motor



Meccano Electric Motor No. 1 (4-volt)

Meccano Resistance Controller

Transformer

Meccano Rheostat

Meccano Clockwork Motor

Meccano Accumulator

Meccano Electric Motor No. 2 (100-250-volt A.C. or D.C.)

Meccano Limited, Old Swan, Liverpool

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